Blue M Full Range Humidity Cabinets
FR-256 Series

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4. Recorder Instruction For Humidity Chambers. I-105-27

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BLUE M
BLUE M Electric Company
CORPORATE HEADQUARTERS: BLUE ISLAND, ILLINOIS 60406

OPERATION AND MAINTENANCE INSTRUCTIONS FOR FR SERIES FULL-RANGE HUMIDITY CHAMBERS WITH PROGRAMMED CONTROL

Your Humidity Chamber is built to the highest industry standards. Read and follow these instructions carefully to assure long life and trouble-free operation.

Temperature Range: -18°C. to +93°C. (0°F. to 200°F.)

RANGE I is standard military testing range and is available continuously.

RANGE II is available on an intermittent basis; programs quoted to order.

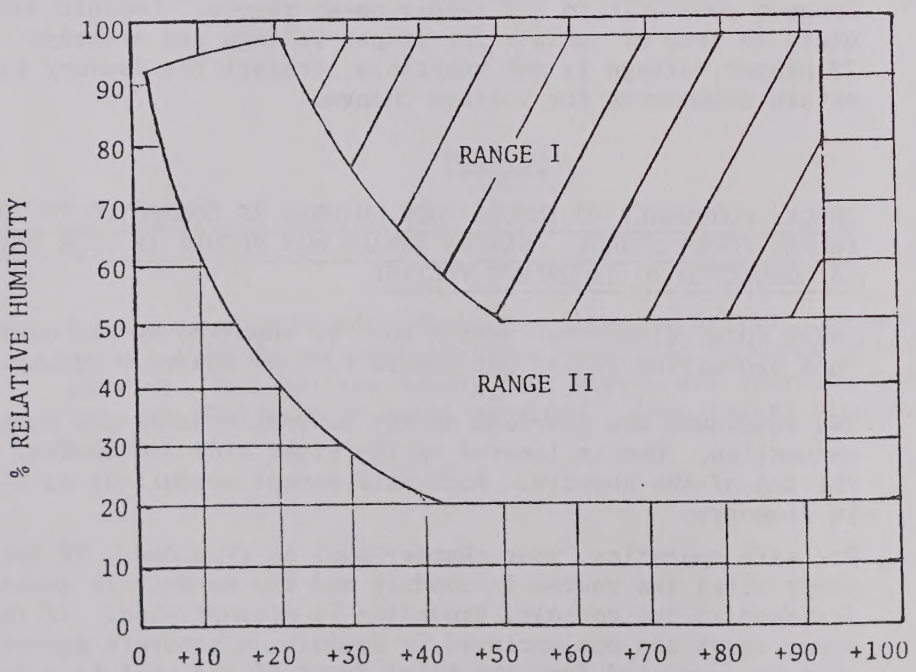


Figure 1

I. INSTALLATION INFORMATION.

A. Inspect your unit carefully for damage sustained in transit. All claims for damage or shortages must be reported immediately to the carrier. Please do not return goods without written authorization.

B. Locate your chamber where line voltage variation is ±10% or less and room temperature is 25°C., ±3°C. for best control accuracy. Avoid overloaded power lines. Do not locate near outside entrances or heating and air conditioning vents. Allow at least 1 foot of clearance around chamber perimeter to facilitate air circulation and safety. Be sure the ventilated panels at chamber bottom are not blocked.

NOTE

Chamber must be level to function properly.

C. Connect your unit to its proper power source. Consult data plate on side of console for proper voltage and amperage. If proper voltage is not available, contact the factory to obtain components for voltage change.

CAUTION

CHECK THOROUGHLY TO INSURE YOUR CHAMBER IS CONNECTED TO THE PROPER POWER SOURCE. SEVERE DAMAGE MAY RESULT IF YOUR UNIT IS CONNECTED TO INCORRECT VOLTAGE.

A main fused disconnect switch must be supplied by the user. Fuse protection should not exceed 125% of amperage rating.

Two knockouts are provided on the control console for power connection. One is located on the right side and another on the top of the console. Both will accept conduit up to 2-1/2" in diameter.

For safe operation, your chamber must be grounded. If the power wires are routed in conduit and the conduit is securely fastened to the console, grounding is accomplished. If the power wires are not enclosed in conduit, a separate ground wire must be connected from the metal frame of the unit to a suitable electrical ground, such as a water pipe.

NOTE

Follow your local electrical code without exception when installing your chamber.

D. Before placing your chamber in operation, loosen the four (4) upper mounting bolts until the compressor floats freely on springs, and remove the two (2) shipping bolts from compressor base. (See Instruction No. I-303-15).

E. For units without WP-4800 Water Purfrication System, connect distilled or demineralized water only to chamber inlet. Run all chamber water drains to an open bill-type drain. (See Figures 2 and 3). This will eliminate back pressure in chamber drains.

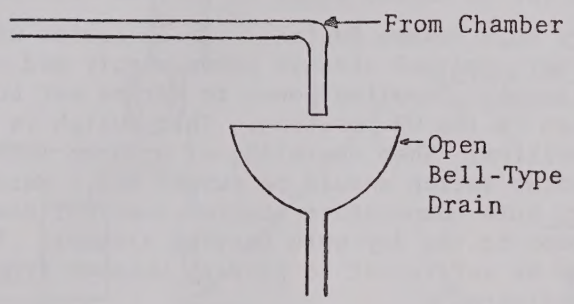


Figure 2

For units with WP-4800 Water Purification System, connect outlet (bottom) of demineralizer cartridge to water inlet of chamber. Run cabinet drain, door drain, and overflow drain into WP-4800 through holes provided. (See Instruction No. I-300-3).

II. OPERATING CONTROLS AND FEATURES.

A. Located on control panel (Refer to Figure 4).

1. Main Switch - Turns 120V control circuit ON or OFF, providing power to chamber.

2. Main Pilot Light - Illuminates when main switch in ON.

3. Wet Bulb Heater Switch - In series with wet bulb reactor, control circuit power supply and wet bulb heating element. Supplies power to the entire wet bulb heating system when in the ON position. Normally, this switch is in the ON unless water is drained from the chamber.

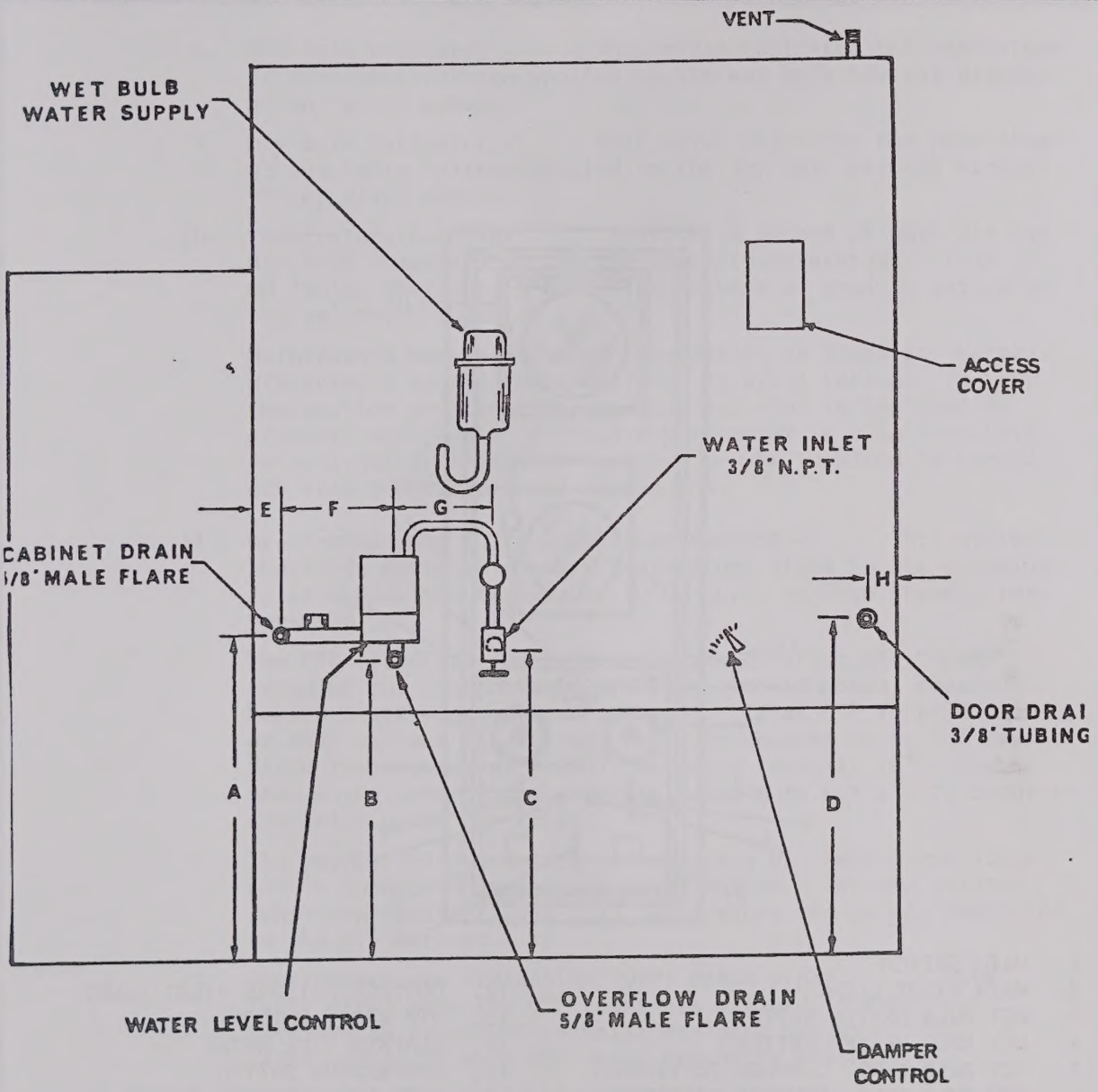
4. Dry Bulb Heater Switch - In series with wet bulb reactor, control circuit power supply and wet bulb heating element. Supplies power to entire wet bulb heating system when in the ON position. This switch is normally in the ON position. When operating at or near 100% RH, the dry bulb heater switch should be turned off. Merely turning down the dry bulb temperature control does not completely shut off power to the dry bulb heating element. This residual power may be sufficient to prevent chamber from reaching desired condition.

5. Wet Bulb Temperature Control (Optional) - This control allows the selection of any wet bulb temperature within the range of the unit. See Instruction No. I-301-13R1, Operation and Calibration of Memory Ring Dial System for complete information on dial use.

6. Dry Bulb Temperature Control (Option) - This control allows the selection of any dry bulb temperature within the range of the unit. See Instruction No. I-301-13R1, Operation and Calibration of Memory Ring Dial System, for complete information on dial use.

7. Finned Coil Switch - (Standard on FR-441 only). Optional on all other models). This switch controls the finned coil solenoid valve. When in the OFF position, refrigerant flows through the main bare tube coil only. This position is used for operating close to ambient temperature with low RH, or for operating below 25°C. This prevents frost on the finned coil.

   When in the ON position, refrigerant flows through both the main bare tube coil and finned tube coils. This position is used when frost on the finned coil is not likely, or when maximum cooling is desired.



	A	B	C	D	E	F	G	H
FR-251, 256	36	32	32	37	1	10 1/2	7 1/2	1
FR-361, 366	29 1/2	25 1/2	25 1/2	30 1/2	1	10 1/2	7 1/2	1
FR-381, 386	36	32	32	37	1	10 1/2	7 1/2	1
FR-441, 446	26	24	25	25	1	10 1/2	7 1/2	1

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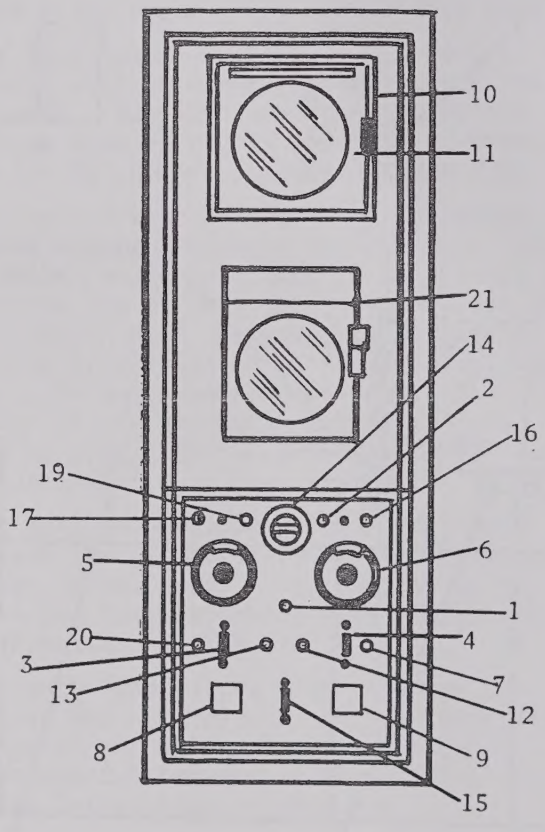


1. MAIN SWITCH
2. MAIN PILOT LIGHT
3. WET BULB HEATER SWITCH
4. DRY BULB HEATER SWITCH
5. WET BULB TEMP. CONTROL (OPTIONAL)
6. DRY BULB TEMP. CONTROL (OPTIONAL)
7. FINNED COIL SWITCH
8. WET BULB VOLTMETER
9. DRY BULB VOLTMETER
10. TEMPERATURE RECORDER
11. OTP (INSIDE RECORDER CASE)
12. CONTROL FAILURE PILOT LIGHT
13. OTP RESET BUTTON
14. ELAPSED TIME METER
15. COMPRESSOR SWITCH
16. HIGH-LOW SELECTOR SWITCH
17. -10°C./+25°C. SWITCH
18. PRESSURE GAUGES (NOT SHOWN)
19. WATER FLOW PILOT LIGHT
20. INTERIOR LIGHT (OPTIONAL)
21. PROGRAMMER-CONTROLLER

FIG 4

8. Wet Bulb Voltmeter - This meter indicates the percentage of available voltage applied to the wet bulb heating element at any given moment.

9. Dry Bulb Voltmeter - This meter indicates the percentage of available voltage applied to the dry bulb heating element at any given moment.

10. Temperature Recorder - Provides a record of both wet and dry bulb temperatures and the humidity maintained. (The RH Table, Instruction No. I-105-20 must be used to determine the relative humidity).

    Maintenance and calibration information is found in the manufacturer's manual (Honeywell No. 95-8268) included in your instruction package. The 24 hour recorder is included as standard equipment. A seven day recorder is also available. An optional differential recorder may be supplied to record dry bulb temperature and depression.

11. Overtemperature (OTP) Protection Control - This device shuts off power if chamber temperature rises to its setpoint. It is set at the factory to 10°C. above maximum chamber temperature.

    The OTP setpoint is regulated by manipulating the "ALARM" setpoint pot (Potentiometer P5) on circuit board, located behind chart plate. (See Figure 5). If an OTP setpoint lower than maximum is desired, run your chamber up to the desired temperature of the OTP setpoint (usually 10°C. higher than actual operational setpoint) and turn pot slowly counterclockwise until OTP trips.

    The purple colored outer pen registers dry bulb temperature and is connected to the OTP alarm switch. The red colored inner pen registers wet bulb temperature and is not connected to the OTP circuit.

12. Overtemperature Protection (OTP) Pilot Light - This light glows when the OTP reset has tripped, chamber temperature is below OTP setpoint and unit has shut down. Light shuts off when OTP reset button is pushed.

13. Overtemperature Protection (OTP) Reset Button - This switch trips after the OTP has cycled several times. Pressing this switch returns unit to service. Be sure to determine the cause of the overtemperature condition before restarting oven.

To adjust time delay device, proceed as described below.

a. Open access door to rear of control panel.

WARNING!

DISCONNECT POWER TO UNIT BEFORE OPENING CONSOLE DOOR

b. Locate resistor on rear of OTP Reset Button. This resistor heats anytime unit temperature exceeds OTP setting. After overheating several times, device trips and shuts unit off.

c. Moving resistor closer to reset device will cause it to trip more quickly, and moving it away will cause it to trip more slowly. It is possible to adjust resistor so that the device never trips. This practice is not recommended. If OTP should trip three (3) times without tripping reset device, resistor is located too far from switch.

d. Operation may be checked by turning unit ON and turning dry bulb temperature control to OTP setpoint. If action of the reset device is inadequate, shut OFF unit and repeat steps b and c.

e. It is recommended that the temperature in work chamber occasionally be raised to the OTP setpoint. Unit should shut off. If not, check OTP reset switch and alarm pot for mechanical or electrical malfunctions.

14. Elapsed Time Meter - This clock is activated whenever the main switch is ON and the unit is operating. It records the running time of the chamber. Use it to plan maintenance according to actual running time.

15. Compressor Switch - Supplies power to the refrigeration compressor when in the ON position. This switch must be ON whenever cooling is required.

16. High-Low Selector Switch - When this switch is placed in the HIGH Position, the by-pass refrigerant solenoid valve is energized, allowing refrigerant to flow through the by-pass bare tube coil, located in the water reservoir. In this position, minimum cooling is provided to maintain a steady wet bulb depression throughout all high temperature cycles.

NOTE

High Position must not be used below +25°C.

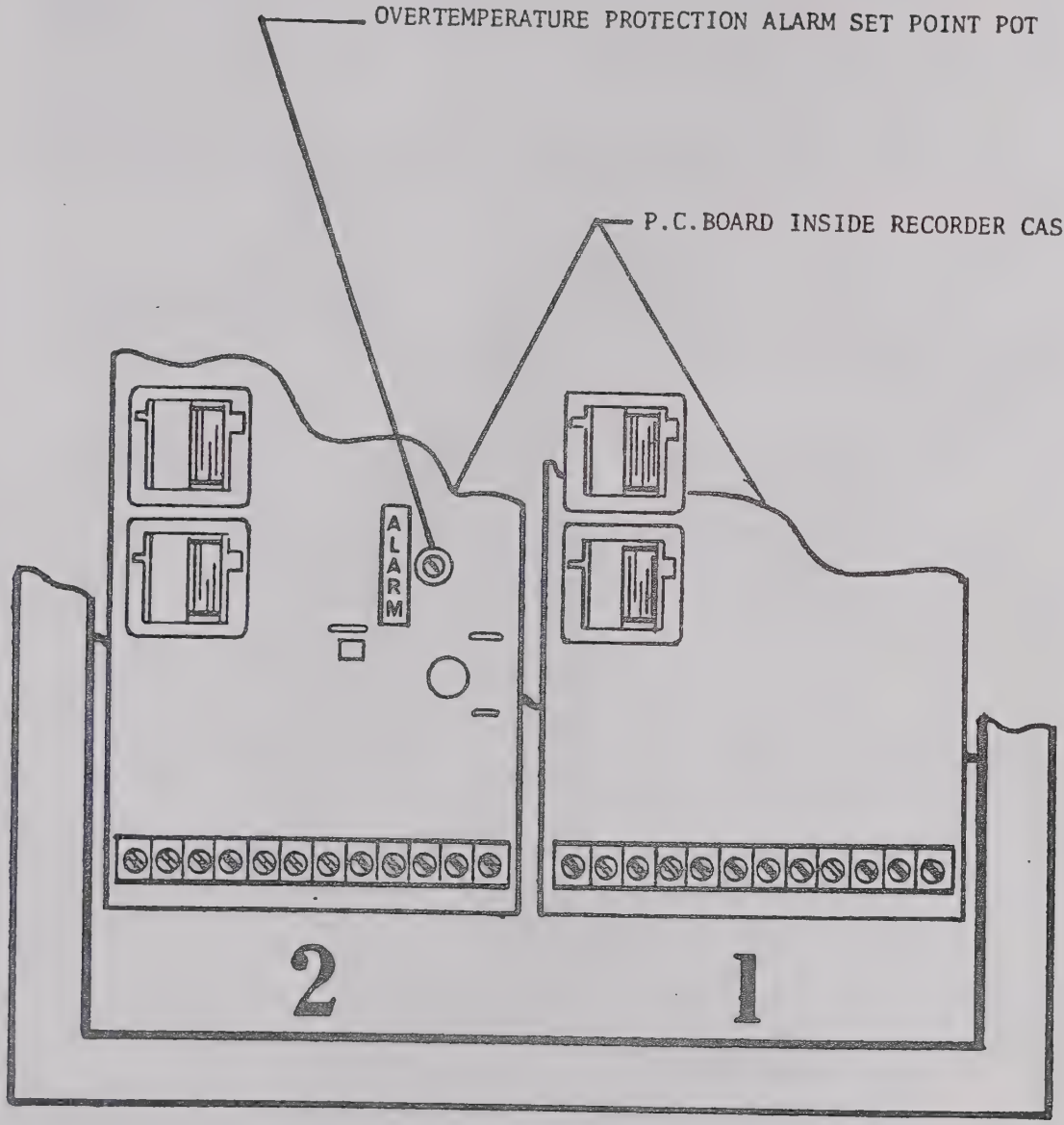

OVERTEMPERATURE PROTECTION ALARM SET POINT POT
P.C.BOARD INSIDE RECORDER CASE
ALARM
2
1

FIG. 5

Moving the switch to Low Position energizes the main refrigerant solenoid valve and allows refrigerant to flow through the finned evaporator coil and main bare tube coil. In the Low Position, refrigeration system is operating at maximum capacity.

The Low Position must be used ONLY for sub-ambient operation or to simulate extremely low humidities at low dry bulb temperatures. Whenever possible, High Position should be used.

NOTE

Units equipped with a separate finned coil switch: The finned coil switch must be in the ON position for refrigerant to flow through the finned coil.

CAUTION!

When starting chamber after shut down of 24 hours or longer, place HIGH/LOW Selector Switch in LOW Position; Allow chamber to operate 5 to 10 minutes. Selector Switch may then be placed in the position appropriate to proper operation. This procedure will prevent oil foaming and prolong compressor life.

17. -10°C./+25°C. Switch - This switch controls power to the cabinet drain solenoid valve, wet bulb reactor power supply, and main refrigerant solenoid valve.

When placed in the -10°C. Position:

a. Cabinet Drain Solenoid Valve is energized, emptying water reservoir.

b. Power to wet bulb heating element is shut off.

c. Main Refrigerant Solenoid Valve is energized, allowing refrigerant to flow through finned evaporator coil providing maximum cooling.

When placed in the +25°C. Position:

a. Cabinet Drain Solenoid is de-energized and the water reservoir fills;

b. Power to the wet bulb heating elements is restored and the by-pass refrigerant solenoid valve is energized. This allows refrigerant to flow through the by-pass bare tube coil, providing minimum cooling for chamber.

When conditions above ambient are desired, place switch in the +25°C. position.

When operating at or below ambient, place switch in -10°C. position.

18. Pressure Gauges - Your chamber is equipped with two (2) refrigeration pressure gauges. The high pressure gauge is installed at compressor discharge. The low pressure gauge is installed in suction line at compressor inlet. See Instruction I-212-2R1 for proper pressure readings.

NOTE

Before contacting Blue M for service, record pressure gauge readings, position of High/Low selector switch and chamber temperature. This information will assist servicing of your unit.

19. Water Flow Pilot Light - This light illuminates when water is flowing into chamber reservoir.

20. Interior Light Switch - (Optional) Turning this switch ON illuminates work chamber.

21. Programmer/Controller - Controls wet and dry bulb temperatures according to a pre-cut cam program. See Instruction I-208-3 for further details.

B. Components Located Off the Control Panel.

1. Water Level Control - (Located on rear of chamber. See Figure 3). Controls water level in conditioning chamber. This device is set at the factory for optimum performance with the calibration point indicated. See Instruction No. I-201-4 for a complete description of the water level control system.

2. Recorder Wet Bulb Wick Water Supply - (See Figure 3) A stainless steel cups holds an inverted 1/2 gallon water bottle which maintains the proper water level for the wet bulb wick box. Adjustment of the metal band surrounding the bottle allows adjustment of water level. Water level in the wick box should be 1/8" to 1/4" from the top.

NOTE

Factory set wick box water level should not be changed. If rough handling has caused band to slip from its position, readjust it to the factory setting.

Bottle and supply box must be cleaned every 30 days or less. When cleaning bottle and box, replace wick on wet bulb sensor.

CAUTION!

ONLY DISTILLED WATER SHOULD BE USED FOR WET BULB WICK WATER SUPPLY.

3. Magnetic Motor Starter - (Located on left inside control console). Provides blower motor overload protection. If motor becomes overloaded, heaters will trip blower motor starter and de-energize the motor starter coil. A fourth contact on the motor starter interlocks with the control circuit and will cause the entire system to shut off. If the blower motor fails to run, shut off power and open access door on rear of console. Locate the blower motor starter on left hand side on the white assembly panel, and push the white reset button.

   Motor heaters are sensitive and will trip for reasons other than motor overload. High ambient temperature, high line voltage, or both may cause tripping when the motor is not overloaded. Check blower motor amperage with the motor running. If amperage is within motor rating (see motor rating plate) replace motor heaters with one size larger to compensate for additional heat. If blower motor starter continues to trip it must be assumed that the blower motor is defective.

NOTE

The compressor motor has built-in automatic overload protection.

4. Fuses - Fuses are located on the white electrical assembly panel inside the control console. Cartridge fuses protect the following components against short circuits: power line; transformer(s); blower motor(s), compressor, and temperature control circuits.

WARNING!

When replacing fuses, be sure all power to chamber is shut off. Replacement fuses must be the same type and rating as original equipment. See the wiring diagram parts list for specifications.

5. Pressure Relief Vent - (Located on top left side of chamber. See Figure 3). This vent maintains inside of chamber at atmospheric pressure. Never allow this vent to become blocked. When chamber is rising in temperature, steam may be emitted from vent. When chamber is cooling, outside air enters vent to compensate for air contracting inside chamber.

CAUTION!

IF VENT BECOMES BLOCKED OR SEALED, PRESSURE DIFFERENCES MAY BE SUFFICIENT TO SHATTER INNER GLASS DOOR AND DAMAGE CHAMBER INTERIOR AND LOAD.

6. Lead-in Ports, Fixturing, etc. - Refer to supplementary instruction (I-303-7) for complete information.

7. Damper Adjustment - (See Figure 3). The damper control is located at the rear of the unit. It allows adjustment of the angle at which air strikes the water surface in the reservoir. With the pointer in the Number 1 Position, rapid agitation of the water occurs and maximum evaporation is effected. With the pointer in the Number 9 Position, airflow is directed above the water surface; this position is used to obtain very low humidity levels.

   The damper should never be set at maximum or minimum (1 or 9), except when extreme humidity conditions are required; e.g., to obtain the maximum humidity at the lowest controllable dry bulb temperature, or to obtain the minimum humidity at higher dry bulb temperatures. A permanent setting between 3 and 6 is sufficient for most average test conditions.

NOTE

When adjusting damper, move only one number at a time. Allow approximately 15 minutes between each adjustment for chamber to stabilize.

CAUTION!

NEVER CLOSE THE DAMPER MORE THAN REQUIRED TO OBTAIN A SPECIFIC HUMIDITY CONDITION. WATER SPRAY PRODUCED BY RAPID AGITATION MAY ENTER WORK CHAMBER AND DAMAGE THE LOAD.

8. Manual/Program Selector Switch - (Optional). Allows selection of either manual or programmed operation. When one mode is selected ther is disconnected automatically.

   In some respects, operation in manual mode is identical to programmed operation. All refrigeration, water level, damper controls, etc., must be operated in the same manner. The difference is that manual controls are used instead of program cams to control temperature and humidity conditions. When in the manual mode, only one condition at a time may be selected.

III. INITIAL CHAMBER CALIBRATION AND OPERATION.

NOTE

The following instructions apply only when initially placing chamber in operation, or when trouble-shooting. Calibration of controls, recorder, etc., should not be necessary during daily operation. For daily operation, see Section IV.

WARNING!

BEFORE PLACING CHAMBER IN OPERATION, CAREFULLY READ OPERATING CONTROLS AND FEATURES (SECTION II) OF THIS MANUAL TO FAMILIARIZE YOURSELF WITH ALL CONTROLS AND THEIR FUNCTION.

Follow these steps to place chamber in operation

NOTE

BE SURE CHAMBER IS LEVEL.

A. Refer to the temperature and humidity recorder instruction (95-8268 and I-105-27) for specific calibration information. It is imperative that the recorder be checked and calibrated before starting any test runs. This will avoid unnecessary adjustment of controls due to a recorder error.

CAUTION!

DO NOT OMIT THIS STEP.

B. Place all appropriate switches in the OFF position.

NOTE

Check standby refrigerant pressures (Section II-A-18) and compare to the information in Instruction No. I-212-2R1. If pressures are not correct, it is possible that the refrigeration system has not been shut down long enough for pressures to stabilize. If pressures are not correct after 8 to 10 hours of inactivity, a malfunction, such as a leak or lack of refrigerant is indicated.

C. Be sure OTP Control is set at least 10°C. higher than desired operating temperature. If not, check Section II-A-12, 13 and 14 of this manual for adjustment procedure. Remember, OTP is normally set at the factory for 10°C. above maximum chamber temperature.

D. Open the water inlet valve at water level control. If optional Water Purification System (WP-4800) is supplied, be sure it is plugged into receptacle on rear of console. Refer to Section II-B-1 and 2 in this manual.

E. Turn ON power at customer supplied fused disconnect switch. Turn ON main switch. The blower motor, recorder, and elapsed time meter will now operate. Main pilot light and water flow pilot light will be illuminated. Inspect water level control box at rear of chamber to see if water is flowing into chamber.

F. Allow chamber to fill with water prior to checking the rest of the unit. When water flow pilot light stays off, chamber is full.

G. Turn dry bulb heater switch to ON Position. With cams removed from programmer, dry bulb voltmeter should indicate full power applied to dry bulb heating element. Open programmer door, and move dry bulb cam follower (rear-most follower in cabinet) to the right.

As "I" Lamination of inductor closes, dry bulb voltmeter should indicate zero (0) voltage. Move cam follower back and forth several times to be sure dry bulb heater is responding.

H. Repeat Step G for the wet bulb control system.

CAUTION!

IMMEDIATELY AFTER PROGRAMMING CONTROLS AND HEATER CIRCUITS ARE CHECKED, REPLACE CAMS IN PROGRAMMER AND ROTATE THEM TO A TEMPERATURE SLIGHTLY ABOVE AMBIENT. THIS PREVENTS CHAMBER TEMPERATURE FROM RISING UNCONTROLLED WHILE THE BALANCE OF THE SYSTEM IS CHECKED.

I. Place High/Low selector switch in LOW Position and turn compressor switch ON. Allow unit to run for 10 to 15 minutes.

J. Move High/Low selector switch to HIGH Position and allow unit to run for approximately 5 minutes. Compare pressure readings on compressor gauges with Table in Instruction No. I-212-2R1.

K. Check operation of cabinet drain solenoid by moving the -10°C/ +25°C. switch to the -10°C. position. If the drain valve opens, proper operation is indicated. Return switch to +25°C. position.

NOTE

Cabinet does not have to be drained completely for this check.

L. MAX-SET (OTP) Control should now be checked. Raise dry bulb temperature just above OTP setpoint. When chamber temperature exceeds OTP setpoint unit should shut down and an audible alarm will sound. See Section II-A-12, 13 and 14 in this manual for further information.

Initial chamber calibration and operation is now complete.

IV. HOW TO OBTAIN A SPECIFIC CONDITION.

NOTE

This section assumes that the temperature recorder, temperature controls, OTP, and related equipment are calibrated and operating normally.

A. Determine temperature and RH condition desired. In this example, 80°C., 96% RH will be used.

B. Using relative humidity chart supplied, (Instruction No. I-105-20), observe that one degree (1°) of depression is needed, therefore the wet bulb temperature is 79°C.

NOTE

Proper switch setting, water level settings, and damper settings are scribed on the program cam for your specific unit. Due to the many special programs and modified chambers supplied, information scribed on the cam takes precedence over information in this operating manual.

C. With cam motor OFF, adjust spiral wet and dry bulb calibrating cams to some arbitrary point and allow unit to stabilize for one (1) hour.

D. Note temperature inside work chamber and reference numbers on cams. It is suggested that a record be kept of chamber temperatures for any reference number to facilitate future programming of unit. Use memory ring on spiral cam.

E. Adjust cams as necessary: Clockwise to increase wet or dry bulb temperature, counter-clockwise to decrease. After each small change in settings, unit should be allowed to stabilize for 30 minutes.

F. Refrigeration controls should be set according to their descriptions in this instruction manual. Even when wet bulb heat controls are turned off, wet bulb heat may be driven up by dry bulb element. If this happens, refrigeration may be used to depress wet bulb temperature to desired level.

G. When desired conditions have been achieved, wet and dry bulb temperatures may be transferred to the blank cam, as explained in the POM-60 Programmer/Controller Instructions (I-208-3). Remember to note settings of refrigeration controls.

V. NORMAL OPERATION.

NOTE

These instructions apply for the normal operation of the chamber. They assume that the chamber is calibrated and functioning properly. If you are in doubt, see Section III in this manual. Initial Chamber Calibration and Operation.

A. Loading the chamber.

1. Make sure that chamber power if OFF.
2. Load test materials into chamber.
3. Close inner and outer doors.

B. Start-Up.

1. The main switch, wet bulb control, dry bulb control and compressor switches should all be set to the OFF position.
2. Loosen program cam nut and set cam to START position. Tighten cam nut finger tight.
3. Turn main switch ON.
4. Place -10°C/+25°C. switch in desired position.
5. If chamber has been off for 24 hours or more:
   a. Place High/Low Switch in LOW Position.
   b. Turn compressor switch ON.
   c. After 10 to 15 minutes, set High/Low switch to position appropriate to proper operation.
   d. Turn wet and dry bulb switch ON as required.
6. If chamber has been off for less than 24 hours, place High/Low, wet bulb, dry bulb and compressor switches into positions required for desired temperature.

VI. MAINTENANCE.

For any maintenance information not contained in this section, refer to specific instruction sheets supplied.

A. Refrigerant Charge - Only qualified refrigeration servicemen should be allowed to recharge the refrigeration system. Proper weight and type of refrigerant will be found on data plate attached to unit. Weights of refrigerant given include an adequate reserve.

Refrigeration system may be either high side liquid charged or low side vapor charged. Initial charge should be made through the high side. A liquid indicator is installed in the liquid line and shows when system is properly charged.

B. Refrigeration System - A preventative maintenance program must be scheduled so the refrigeration system is regularly checked for leaks and compressor oil level.

The time period between checks should be determined by hours of use (approximately 1000 hours) and in accordance with general commercial practice. Two (2) inspections per year are absolute minimum.

When normal environmental conditions prevail, the air cooled compressor condenser coil must be cleaned every six (6) months. If cabinet is installed in an abnormal environment, clean more frequently. A high pressure air hose is suitable to blow dirt and dust OUT of condenser.

Before checking compressor oil level, allow chamber to operate for 10 to 15 minutes with High/Low Selector Switch in LOW position. Oil level may then be checked with chamber operating. Oil recommended for use in compressor is Suniso #3GS. DO NOT OVERFILL. Excessive oil in system tends to reduce heat transfer and increase temperature differential between evaporator and condenser. Every six (6) months it is recommended the pressure gauge readings be checked.

C. Blower Motor System - Blower motor is supplied with sealed ball bearings which do not require lubrication.

D. Calibration - Periodically an independent temperature test instrument must be used for an accuracy check for control dials and temperature recorder. Consult specific instruction (95-8268 and I-301-13R1) for calibration procedures.

E. Water Reservoir Draining Procedure - With unit turned ON, heaters and compressors OFF, place -10°C. position; water drain solenoid valve will open.

F. Maintenance Checklist - The following is a suggested checklist. Time intervals between specific operations are considered minimum. If chamber is operated in a dirty, dusty, or corrosive atmosphere, maintenance must be performed more frequently.

1. Daily, When Chamber in Use:

   a. Check recorder chart.

   b. Check compressor pressure gauges for proper reading.

   c. Replace recorder pen cartridges as required.

2. Every 10 Days:

   a. Purge water from chamber and refill.

   b. Siphon water from wick box in chamber. It will refill itself automatically.

   c. Check water level in Wick Box Bottle on back of chamber. Refill with distilled water only.

   d. Wipe inside floor of chamber with clean white rags, NOT red shop rags. Dampen with distilled water as needed and remove all residue and dust from chamber.

   e. Clean exterior of chamber.

3. Every Month:

   a. Change wet bulb wick in wick box and clean element.

   b. Check all water filters and demineralizers. Change filters and demineralizers every 1,500 hours of operation, or as color change of crystals reach line on output end of cartridge.

4. Every 4 Months:

   a. Clean Water Level Control Box, float and tube.

5. Every 6 Months:

   a. Clean condenser with vacuum cleaner.

b. Check Compressor oil level after 15 minutes in "LOW" at room temperature (Recommended oil, Suniso No. 3GS).

6. Every 8000 Hours of Operation:

a. Turn main power line of chamber OFF at fused disconnect switch.

b. Remove interior baffles.

c. Thoroughly clean interior with Joy dishwashing liquid soap or equal solution. Scrub until clean. Use stainless steel wool if needed to remove stubborn spots and stains. Rinse thoroughly, drain, and dry with a clean white cloth, NOT shop rags. Make sure all solids have been removed. Passivate any rust spots.

d. Replace any part showing signs of permanent corrosion.

e. Clean out WP-4800A (if applicable) and refill.

BLUE M

BLUE M Electric Company

Corporate Headquaters: Blue Island, Illinois 60406

SUPPLEMENTARY INSTRUCTIONS FOR BLUE M TEMPERATURE/HUMIDITY CABINETS

This instruction contains a glossary and principle of operation that apply to Blue M Temperature/Humidity Cabinets. It also contains information on the installation of lead-in ports and fixturing, and maintenance information. Check instructions for specific model for further information as necessary.

I. GLOSSARY OF TERMS

A. RELATIVE HUMIDITY (RH)
Amount of water vapor present in a given volume of air expressed as a percentage of maximum amount possible in that volume at same temperature.

Example: A relative humidity of 75% means that air contains 75% of maxium moisture possible at that temperature.

B. SPECIFIC HUMIDITY
Mass of water vapor per unit mass of dry components of air. Specific humidity is usually expressed in grains per pound of dry air. One (1) pound equals 7000 grains.

C. DRY BULB TEMPERATURE
Temperature of air or gas as measured by an ordinary thermometer.

D. WET BULB TEMPERATURE
Temperature as measured by a thermometer when its bulb is covered by a layer of wet cloth. Evaporation of moisture from cloth into air cools bulb of thermometer, lowering indication. Wet bulb temperature is used in determining relative humidity.

E. DEW POINT
Temperature at which condensation begins at a given RH, volume and pressure. As temperature decreases, dew point increases. NOTE: dew point is always lower than wet bulb temperature, except when air is saturated. At this point, dew point, wet bulb and dry bulb temperature coincide.

F. DEPRESSION (DIFFERENTIAL)
Temperature difference between wet and dry bulb temperatures. Value of temperature difference allows determination of relative humidity by using a psychometric table.

Example:		
	Dry Bulb Temperature	+120°F.
	Wet Bulb Temperature	+110°F.
	Depression	10°F.
	Relative Humidity	= 72%

II. BASIC PRINCIPLE OF OPERATION

EVERY COMBINATION OF DRY BULB TEMPERATURE AND RELATIVE HUMIDITY RESULTS IN A SPECIFIC DEW POINT.

From above relationship, it can be readily seen that if air is cooled to dew point of desired relative humidity and dry bulb temperature condition, then saturated at this dew point, and then heated to desired dry bulb temperature, desired condition will result.

Example: Desired condition: 60% relative humidity and +80°F. dry bulb temperature.

Dew point of above condition as obtained from psychometric chart is: +65°F.

Air, at any condtion of relative humidity and temperature, is brought to a temperature of +65°F. (dew point of desired condition). Air is then saturated with water vapor. This saturated air is then heated to +80°F. (desired dry bulb temperature) and expelled into humidity cabinet. This air will be at a dry bulb temperature of 80°F. with a relative humidity of 60%.

Above principle of operation applies to all Blue M Temperature/Humidity Cabinets. Differences in locations and in types of conditioning components are determined by cabinets temperature range, overall size, type, etc.

III. METHOD OF COOLING

All models other than AC and some VP models use non-cycling, constant operation refrigeration systems. Some VP models use water; AC models use room ambient air as cooling medium. Refer to AC cabinet drawing; air is propelled through rear cavity, cooling rear heat exhanger chamber wall plate. Internal blower forces air through rear plenum where it is cooled and controlled to maintain dew point temperature. Non-cycling refrigeration and air cooling as used in AC models are Blue M designs with patents pending.

IV. MOUNTING METHODS FOR INTERNAL FIXTURING

Many applications for temperature/humidity cabinets involve installation of internal fixtures to support components being tested and necessitate additional lead-in ports to provide entrance for wires, cables, thermocouples, etc. If installation of lead-in ports or fixtures are contemplated, **following information must be carefully studied. Failure to do so may result in considerable expense and cabinet down-time.**

DO NOT INDISCRIMINATELY PERFORATE THE INNER CHAMBER WALLS:

A machine screw or sheet metal screw **DOES NOT CONSTITUTE A VAPOR-TIGHT SEAL.** When simulating high temperature, high humidity condition, water vapor will seep thru screw threads into insulation, saturate insulation and water drippage will start at bottom of outer housing.

ALL DRILLING AND TAPPING MUST BE CONFINED TO THE FALSE INNER CHAMBER WALLS LISTED BELOW.

Model Number Prefix —
AC . . . . . rear, top, bottom
CFR . . . . . rear, top, bottom
CPR . . . . . rear, top, bottom
FR, HR, LR . . . . . left, right sides, bottom
POM . . . . . rear, top, bottom

Surfaces where drilling and tapping are permitted are false inner walls. These walls must be removed prior to these operations to avoid damaging internal components. Removal of these panels also insures that drilling and tapping chips do not cause future corrosion problems within chamber.

NOTE: PERFORATION OF NON-RECOMMENDED SURFACES WILL VOID WARRANTY.

Fixtures must be designed to facilitate their removal during regular maintenance and cleaning of the chamber. Failure to design fixtures properly may cause unnecessary delay when equipment is shut down for cleaning or maintenance.

NOTE: ANY FIXTURING OR REMOVABLE PARTS OF CABINET SHOWING SIGNS OF PERMANENT CORROSION SHOULD BE REPLACED.

V. LEAD-IN PORTS

LOCATIONS FOR LEAD-IN PORTS MUST BE CONFINED TO THE POSITIONS LISTED BELOW.

Model Number Prefix —
AC . . . . . left, right sidewalls
CFR . . . . . left, right sidewalls
CPR . . . . . left, right sidewalls
POM . . . . . left, right sidewalls
FR, HR, LR . . . . . contact factory

The top panel of a humidity cabinet is a **POOR** location for a lead-in port and is not recommended. Wherever a lead-in port is attached to inner chamber, it will be below dew point temperature of high temperature, high humidity conditions, and will form heavy condensation at this point. In addition, electrical cables coming through will be cold and cause heavy condensation on the work load below. If it is absolutely necessary to come through a top panel, then ports should be located at rear or in a corner where any condensation will not saturate workload.

Only recommended method of sealing lead-in ports is to heli-arc weld port to inner chamber wall. Where welding is not possible, silicone rubber gasketing material or silicone rubber cement are suitable sealing materials. These materials should not be considered permanent; they are subject to deterioration over long term use and should be inspected and replaced frequently. If there are doubts as to specific installations, contact factory.

VI. MATERIALS FOR CONSTRUCTION OF LEAD-IN PORTS AND FIXTURES

A. All lead-in ports and fixtures must be constructed of materials not subject to rapid corrosion. Interior of chamber is constructed of Type 316 Stainless Steel; any additions to chamber must be of equal or better grade. This applies not only to ports and fixtures, but to screws and related hardware to construct and mount them.

B. Do not use any low alloy iron materials in cabinet interior (see paragraph E). This applies particularly to any type of cold or hot rolled steel, either painted or plated. Painted or plated surfaces soon deteriorate under high temperature and humidity conditions. Two reasons to avoid use of low alloy materials are:

1. Corroding steel will 'seed' stainless steel with particles of rust. These particles will cause rapid deterioration in any stainless steel it contacts. Once such chemical corrosion starts, it can only be stopped by electropolishing or passivation.

2. This "seeding process" will cause similar corrosion on test loads; effects of this corrosion will be impossible to separate from temperature and humidity effects, and may void test results.

C. After fabrication of stainless steel fixtures, it is essential that they be passivated before being placed in cabinet. This is the only effective method in assuring that fixtures are free of contaminants. Particles of tool steel remain inbedded in stainless steel after drilling, punching and other fabrication processes. These particles must be removed, or they will begin to corrode rapidly in high temperature and humidity conditions. If such corrosion is allowed to continue, surrounding stainless steel will also corrode.

D. Supplementary gear such as plugs, sockets, wiring and printed circuit boards must be of a quality to last longer than components under test. All supplementary equipment, fixtures, and cabinets are subjected to same conditions as test load, and should be chosen with care.

E. When components to be tested are ferrous metals and are expected to corrode or purpose of test is to "force" corrosion, provision should be made to provide drip pans to retain any residue produced. This prevents residue from contacting cabinet inner chamber areas, recorder and/or control sensing bulbs. On FR model chambers with horizontal airflow, a light gauged stainless steel pan placed on bottom shelf should be considered expendable and may periodically be removed and discarded. AC, CFR, CPR, POM and VP models with vertical airflow can not use a solid pan as it impedes this vertical airflow. In these models we recommend employing smaller trays or formed foil directly under points of drippage without impeding airflow.

F. **ANY PART OF FIXTURING OR ANY REMOVABLE SECTIONS OF CABINET ENTERIOR SHOWING SIGNS OF PERMANENT CORROSION THAT CANNOT BE ELIMINATED BY PROPER CLEANING SHOULD BE IMMEDIATELY REMOVED AND REPLACED.**

VII. ELECTRICAL INSULATING MATERIAL

When electrical voltages are impressed upon components under test, all insulating materials must be suitable for high temperature/high humidity conditions. **Even very small leakage currents traveling through cabinet or fixture will produce rapid electrolytic corrosion.** Fixture should be completely insulated from cabinet. This is necessary to confine electrolytic corrosion just to fixture. Glazed porcelain or glass insulators, treated with Dow Corning 200 Silicon fluid, appear to be some of the best materials presently available.

VIII. LOADING DENSITY

Owners often overload cabinets, seeking to make most use of test equipment. While some conditions will permit indiscriminate loading, most will not. If wide tolerances are permissible, maximum loading of work chamber is permissible. It should be kept in mind, however, that fewer components in work chamber generally means closer tolerances. It is recommended that no component be loaded closer than three inches to an internal surface. If extremely close tolerences in testing are required, it is recommended that a dummy load simulating the component in size and mass be placed in chamber and a test program run.

If it is difficult to produce desired accuracy, load may be too large for chamber.

IX. SEALING CABLE ENTRANCE PORTS

All entrance ports for large diameter cables or wire bundles must be sealed before cabinet is placed in operation. This precaution is often neglected and can cause annoying problems. Condensation will continually run down the cable and drip on floor or external instruments. Excessive water usage will occur because of these openings to atmosphere. If opening is very large, internal control stability can be affected. Silicone rubber cement is a suitable filler for these points provided a more sophisticated sealing method is not available.

X. CONDENSATION

All Blue M humidity chambers are capable of operating at high temperatures and up to 95% relative humidity without condensation forming on workload. Some condensation may form on walls of work chamber; these are areas of heat loss and are slightly cooler than rest of chamber. Such condensation is normal and should not be considered as a malfunction of cabinet. Severe condensation normally forms on components when loaded into cabinet that is operating at high temperature and humidity. Any material at ambient temperature may be below dew point and condensation may form on surface and continue to form until material temperature raises above dew point.

TO AVOID CONDENSATION WHEN LOADING CHAMBER:

A. Test load and chamber at ambient temperature.

1. Turn wet bulb heat OFF.
2. Load chamber, close doors.
3. Set dry bulb temperature for desired temperature and allow chamber to stabilize.
4. In small steps, adjust wet bulb temperature for desired setting. If wet bulb heat is applied too quickly, dew point may rise faster than temperature of test load, creating condensation on load surface. This effect will be most noticable on high mass loads.

B. Test load at ambient, chamber at high temperature and humidity;

1. Turn wet and dry bulb temperature controls OFF, allowing blower to continue operating.
2. Open inner and outer doors.
3. Allow chamber to cool approximately 20 minutes.
4. Chamber can be loaded and operated normally as outlined in "A".

C. To unload chamber, remove load quickly upon completion of test before load can loose temperature to atmosphere.

XI. MAINTENANCE AND TROUBLE-SHOOTING

A. Refrigeration system; refer to enclosed instruction for information regarding maintenance of refrigeration systems.

B. Motors

1. Lubrication — All motors are permenantly lubricated and require no maintenance.
2. Motor Starters — Magnetic motor starter (located in console or control compartment) provides protection for blower motor; interlocked with control circuit; in event of blower motor failure, entire unit shuts down. To re-start unit, wait two minutes, press reset button (models CFR, CPR, FR).

C. Blower Shaft Seal.

If cabinet appears to use excessive amounts of water and water level control is operating properly, check blower shaft seal, door seals, ports, etc. for leakage. If worn, remove and replace; refer to parts list for replacement part.

D. Door Gaskets — Periodically inspect inner and outer door gaskets for cracking, tearing, etc. If gaskets are damaged, remove and replace. Strip old gasket from channel and force new gasket in. Refer to parts list for replacement number.

E. Wet Bulb Wick — Replace at least every 30 days or as soon as discoloration is noticed. Failure to replace as instructed may result in wet bulb recorder failure or inaccurate readings.

F. Demineralizing Cartridges — On chambers with disposable cartidges; as cartridge is used, contents will begin to change color. When color change reaches line on label located at OUTPUT end of cartridge, remove and replace.

G. Cleaning

1. Periodically clean all dust and grime from interior of control console and refrigeration compartment.
2. Interior — Program outlined below is minimal; if chamber is operated under abnormal conditions, (i.e., dirty water supply, contaminated test loads, corrosive atmosphere, etc.) increase frequency. Drain reservoir — refill and drain again.

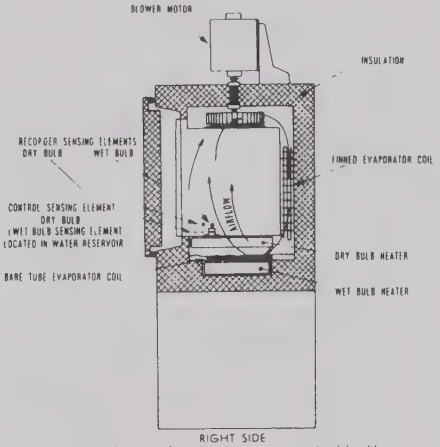
a. Every 500 operating hours: drain and clean wet bulb wick box, recorder sensing elements, dry bulb sensing element, and all interior surfaces (walls, bottom, door interior). Use clean cloth and warm water. If necessary, use stainless steel wool on stains. UNDER NO CIRCUMSTANCES USE ORDINARY STEEL WOOL: THIS WILL SCRATCH AND CAUSE CORROSION.

b. Every 4000 operating hours: remove interior baffles and dry bulb sensing element. Clean all interior surfaces, including all sensing elements with mild detergent. Scrub all exposed surfaces until clean, using stainless steel wool if necessary. (See "a") Rinse thoroughly and dry with clean cloth. Remove contaminants from water reservoir.

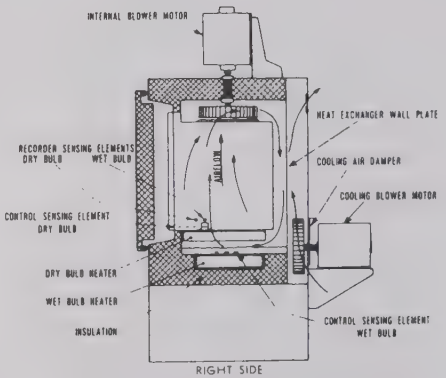
c. When humidity cabinet is under continuous use for high temperature/humidity testing, cabinet MUST be emptied after every test cycle; such cleaning as is necessary should be performed, then cabinet may be refilled with de-mineralized water. Optimum cleaning (as outlined in "a" and "b") interval under these conditions is ten days. Maximum interval is thirty days.

d. Water strainers — strainers must be cleaned every three months if chamber is in daily use; every six months if chamber is in sporadic use. These schedules are minimums; cleaning frequency should be increased if water supply is dirty, contaminated, etc. To clean strainer; turn OFF power to unit, shut OFF main water supply. Loosen hex head brass nut on "Y" type filter (located on back of chamber) and remove filter. Flush clean with tap water, dislodging particles with soft brush. Replace filter and tighten into place.

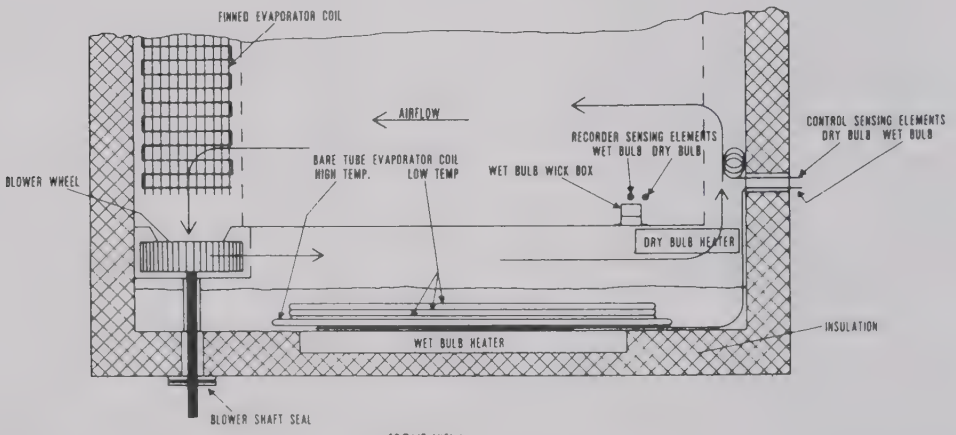
NOTE: FAILURE TO FOLLOW THESE INSTRUCTIONS MAY CAUSE DAMAGE TO UNIT. SUCH DAMAGE WILL NOT BE COVERED BY WARRANTY.



RIGHT SIDE
Pictorial view of conditioning components. Models with "CFR" "CPR" and "POM" prefix



RIGHT SIDE
Pictorial view of conditioning components. Models with "AC" prefix



FRONT VIEW
Pictorial view of conditioning components. Models with "FR" prefix

BLUE M
A UNIT OF GENERAL SIGNAL
BLUE ISLAND, ILLINOIS 60406

(MASTER COPY DO NOT SEND OUT)

BLUE M PART NO.	HONEYWELL MODEL NO.	BOX OF 100 CHARTS BLUE M PART NO. FAHRENHEIT	CELSIUS	CHART ROTATION & FREQUENCY	SENSOR BLUE M PART NO.	TEMPERATURE RANGE
C05B-2-1	AR11ALS1-051	C10G-1-51	C10A-1-53	24 HOUR 60HZ	C11C-1-5 RTD Bulb 100Ω Platinum	0°F to 200°F
C05B-2-2	AR11BLS1-051	C10A-1-52	C10A-1-54	7 DAY 60HZ	C11C-1-5 RTD Bulb 100Ω Platinum	-18°C to +94°C
C05B-2-3	AR11ALS1-114	C10A-1-57	C10A-1-55	24 HOUR 60HZ	C11B-1-1 Type J T/C	-50°F to +300°F
C05B-2-4	AR11BLS1-114	C10A-1-58	C10A-1-56	7 DAY 60HZ	C11B-1-1 Type J T/C	-46°C to +150°C
C05B-2-5	AR11ALS2-602	C10A-1-85	C10A-1-87	24 Hour 60HZ	C11C-1-5 RTD 100Ω Dry Bulb and	Pen 1 - 0 to 63°F.
C05B-2-6	AR11BLS2-602	C10A-1-86	C10A-1-88	7 Day 60HZ	2 C11C-1-6 RTD 200Ω Wet Bulb.	Pen 2- 0 to 200°F.

ALL RECORDERS LISTED ABOVE USE WET BULB WICK (BLUE M PART NO) C10F-4 FOR 100Ω AND TYPE J, C10F-5 FOR 200Ω

AR-100 RECORDERS FOR ALL HUMIDITY CHAMBERS

Mercury filled recorders are no longer used on Blue M Humidity Chambers. Electronic recorders are faster responding, easier to calibrate, and eliminate the use of mercury in sensing systems. We are providing this information sheet to furnish you with basic information on Honeywell AR-100 Recorders as used on our equipment. Additional data can be found in the Honeywell instruction manual provided with your unit. (See Note III.)

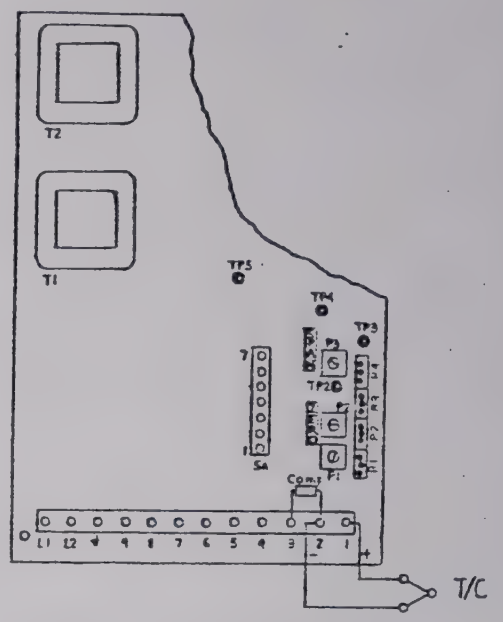
CALIBRATION

1. Open Door and swing chart plate forward.
2. Notice two separate circuit boards (one for each pen) located in rear of instrument case.
3. Refer to Fig.1 and locate "Span" and "zero" pots on each circuit board.
4. "Zero" pot (P2) provides the zero adjustment. Clockwise rotation of this pot makes the pen write at a higher chart value.
5. "Span" pot (P3) adjusts the span. Clockwise rotation of this pot increases the span; i.e., a greater input signal span is required to cover 0-100% of chart width.
6. Be sure to perform these procedures for each pen, on each separate circuit board.

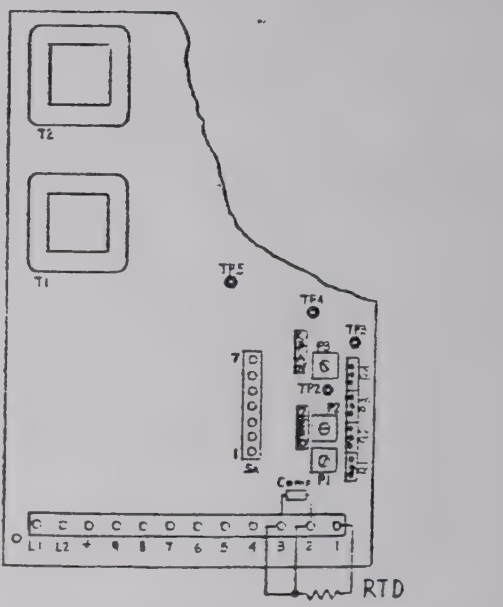
NOTE I: Purple Pen (Left PCB Amplifier) is dry bulb.
Red Pen (Right PCB Amplifier) is wet bulb.

NOTE II: It is recommended that wicks be tied in place with plain white cotton thread.

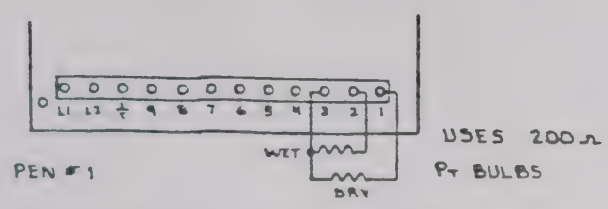
NOTE III: Please disregard any information in standard instructions that may refer to the liquid filled recorder. The information on this sheet is most recent and correct.



CONNECTION FOR T/C SHOWN



CONNECTION FOR RTD SHOWN



DIFFERENTIAL PEN CONNECTORS

LET	BY	DATE	CHKD	APPR	REVISIONS

BLUE M Electric Company
BLUE ISLAND, ILLINOIS

PART NAME AR-100 Instruction for Humidity Chambers

USED ON All Humidity Chambers

SCALE	DATE	DRAWING NO	REV
~	12-19-79	I-105-27R1	

DRAWN	CHKD	APPR
LE	WS	JAL

BLUE M

A UNIT OF GENERAL SIGNAL
BLUE ISLAND, ILLINOIS 60406

MAINTENANCE AND OPERATING INSTRUCTIONS FOR BLUE M CRYSTAL CLEAR WATER PURIFICATION SYSTEM

INSTRUCTION
No. I-1008-10A
I-300-3

Now it is possible to effectively combat corrosion—one of the main causes of down-time in humidity cabinets—with an efficient, low-cost, self-contained unit that quickly pays for itself. The Blue M Crystal-Clear Water Purification System is a carefully designed and built accessory especially engineered to provide pure water free of the dissolved solids and gases found in natural water which adversely affect stainless surfaces, particularly when heated to elevated temperatures.

INSTALLATION (Refer to Figure)

1. Connect line from bottom of demineralizing cartridge to point on cabinet marked "water in".
2. Run cabinet drain(s) directly to tank of WP-4800. Drain(s) should enter tank through holes provided in cover and terminate above the surface of water in tank.
3. Plug WP-4800 into outlet on rear of cabinet.
4. Fill tank with approximately 40 gallons of distilled water. DO NOT ADD MORE WATER when cabinet is operating without taking into consideration amount of water (anywhere from 5 to 15 gallons) in the cabinet water reservoir. Certain humidity cabinets automatically drain when operating near 0°C.

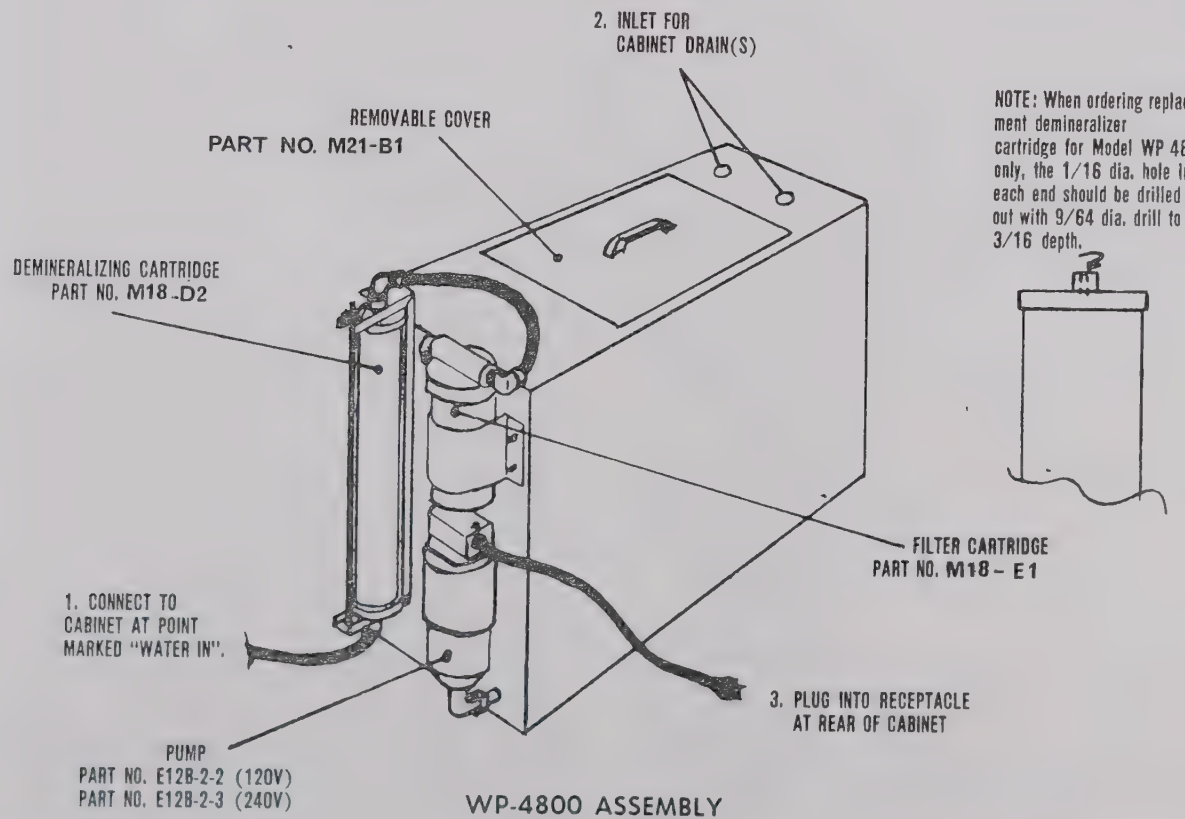
MAINTENANCE

Filter . . . Replace every three (3) months and/or whenever filter element turns a light brown color.

Demineralizing Cartridge . . . Replace every 60 days.

REPLACEMENT PARTS AVAILABLE FROM STOCK

Filter Cartridge	Part No. M18-E1
Demineralizing Cartridge	Part No. M18-D2
Pump — 120V	Part No. E12B-2-2
Pump — 240V	Part No. E12B-2-3


2. INLET FOR CABINET DRAIN(S)
REMOVABLE COVER
PART NO. M21-B1
DEMINERALIZING CARTRIDGE
PART NO. M18-D2
FILTER CARTRIDGE
PART NO. M18 - E1
1. CONNECT TO CABINET AT POINT MARKED "WATER IN".
3. PLUG INTO RECEPTACLE AT REAR OF CABINET
PUMP
PART NO. E12B-2-2 (120V)
PART NO. E12B-2-3 (240V)
NOTE: When ordering replacement demineralizer cartridge for Model WP 4800 only, the 1/16 dia. hole in each end should be drilled out with 9/64 dia. drill to 3/16 depth.

WP-4800 ASSEMBLY

BLUE M
A UNIT OF GENERAL SIGNAL
BLUE ISLAND, ILLINOIS 60406

CALIBRATION AND START-UP PROCEDURE FOR MIL-202C, METHOD 106B, STEPS 1 THRU 7A; MIL-5272C; MIL-STD-810; MIL-T-5422E

I. PROPER SETUP OF CONTROL CONSOLE INSTRUMENTS – MIL-STD-202C

A) Place cams in programmer with cam followers on the +25°C. portion of the cam.

B) Cam switch located inside programmer case set to "Off" position.

C) Following switches turned to the "ON" position.
1. Circuit breaker
2. Dry bulb heater switch
3. Compressor switch
4. Wet bulb heater switch

D) Set High-Low switch to "High" position.

E) Set selector switch to +25°C. position.

II PROGRAM-CONTROLLER AND CAM CALIBRATION – MIL-STD-202C

Before proceeding with calibration, there are four (4) important points to be noted and remembered.

1. If cabinet is supplied with factory cut MIL-202 cams, THE CAMS ARE CORRECT. DO NOT RECUT OR TAMPER WITH CAMS.
2. ALL CALIBRATING ADJUSTMENTS MADE WITHIN PROGRAM-CONTROLLER USING CALIBRATING NUTS ARE MADE ONLY AT +65°C. PORTION OF CYCLE.
3. Allow sufficient time between calibrating adjustments to be sure chamber has reached equilibrium. Since reactions of a temperature and humidity change in response to a calibrating adjustment are slow, tendency is to over-compensate calibrating adjustments. Calibrating adjustments are only made when recorder indicates a completely stabilized condition. After making a calibrating adjustment, allow at least 20 minutes before readjusting.
4. BE CERTAIN THAT RECORDER IS ACCURATELY CALIBRATED! THIS IS EXTREMELY IMPORTANT! Refer to enclosed recorder instruction number I-1007-10.

A. With all controls and switches set as outlined in section I, allow unit to operate a minimum of one hour. Temperature will stabilize at approximately +25°C. This check determines if water level and air damper control are properly set. Technically, to be within the specifications of MIL-202, at +25°C., wet and dry bulb lines should be pressed right together (0° depression). Since the dry bulb control is not used for this portion of test, the condition is controlled by water level and the direction air passes over the water reservoir. If depression is in excess of $\frac{1}{2}$°C. it must be assumed water level is too low. Raise level slightly, but not more than $\frac{1}{8}$ inch each time. Allow cabinet again to operate for 20 to 30 minutes. This procedure should "close" lines together. If not, air directional damper should be moved slightly towards "closed" position. EXTREME CARE SHOULD BE TAKEN WHEN RAISING THE WATER LEVEL. If too high, water will be forced out through blower shaft entrance port and sprayed over refrigeration system. In addition, if solid particles of water are noted circulating in the chamber, it must also be assumed the water level is set too high. Approximately 20 minutes will elapse before any effect will be noted on chart due to water level changes.

B) After ascertaining wet and dry bulb depression is suitable for +25°C. operation, loosen cam lock nut on programmer and manually rotate cams to +65°C. position.

C) After stabilization (approximately one hour), the dry bulb temperature should be at +65°C. and the wet bulb temperature approximately $1\frac{1}{2}$°C. lower. If recorder does not indicate this condition, the calibrating nuts in programming control must be adjusted. Adjustments should be made carefully allowing 15 to 20 minutes between adjustments. One revolution of the calibrating nut is approximately a 20°C. change. Raising calibration of one temperature will tend to raise calibration of the other. For example: If depression is correct but the dry bulb temperature is reading 62°C., then raise calibration of dry bulb control only. This will also increase wet bulb temperature. A minor calibration of wet bulb temperature may be necessary after achieving stabilization.

D) Calibrating adjustments at +65°C., if necessary, will also bring temperature within tolerance at 25°C.

NOTE: THE FOLLOWING STEPS (E) THRU (J) ONLY APPLY TO CABINETS WITH AUTOMATIC —10°C. FEATURE. (MODEL NO. PREFIX "FR")

E) The next step is to check the cabinet on —10°C. portion of cycle. Loosen cam nut and rotate cams to +25°C. position. Allow temperature to drop to +25°C.

F) After cabinet has stabilized at +25°C., place selector switch in —10°C. position and manually rotate cam to —10°C. position.

G) At this point, wet bulb heat and water level control will shut off, cabinet will be draining and refrigeration circuit automatically switched to "Low".

H) The chamber should stabilize at —10°C. in approximately one hour. Should it take substantially longer than one hour, it must be assumed chamber is not draining properly. Check for restrictions in drain line and make sure the cabinet is level. If water reservoir is not completely drained, temperature will taper off at approximately 2° or 3° below 0°C. and drop very slowly until entire water reservoir freezes.

I) After chamber has stabilized at —10°C., manually rotate cams back to +25°C. position.

J) At this point, wet bulb and dry bulb heat are back on, water solenoid is open, and refrigeration circuit has been switched back to "High".

K) Cabinet should now be completely calibrated. However, after a full 24-hour run, minor adjustments may be necessary. To start program, turn cam motor switch "On".

L) Most commonly noted on the first few charts is the following:

At beginning of +65°C. portion of cycle, dry bulb line is pressed together with wet bulb line for first 30 to 60 minutes of cycle and then dry bulb line drifts up to its normal position holding steady for duration of cycle. Occasionally this condition is noted at beginning of both +65°C. cycles but more often it is found only on +65°C. cycle immediately following —10° dip. Reason for this is condensation on recorder dry bulb sensing element. In effect, this condition makes a wet bulb indicator of dry bulb sensing element, and dry bulb recorder pen will actually be reading a wet bulb temperature until the condensation evaporates. When cabinet transfers from —10°C. condition, temperature and humidity rise quite rapidly. Recorder sensing bulbs have a considerable mass of stainless steel and mercury, and therefore will be considerably behind actual cabinet temperature on extremely rapid rises. This produces condensation on dry bulb recorder sensing element which remains on bulb throughout rise to +65°C. IT IS COMPLETELY FALSE INDICATION, however. It does produce cause for argument since the chart does indicate a condition of 100% for a brief time which exceeds MIL-202 tolerances.

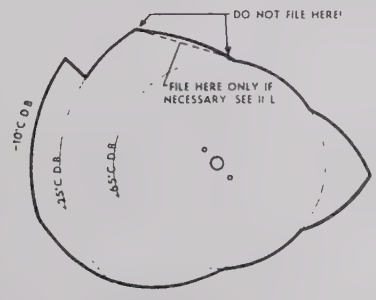


FIGURE 1

Correcting this problem is relatively simple. File cam down slightly (1/16" maximum) as shown in Figure 1. DO NOT FILE NEAR EITHER END OF THE RISE FROM +25°C. TO +65°C. AS SHOWN BY "A". If cam were filed near +25°C. and +65°C. the time pattern would be shifted on the chart and the dry bulb temperature would be at +65°C. in excess of three hours.

III. INSTRUCTIONS FOR MIL-E-5272C, MIL-T-5422E, MIL-STD-810

A) BE CERTAIN THAT RECORDER IS ACCURATELY CALIBRATED! THIS IS EXTREMELY IMPORTANT. Refer to enclosed recorder instruction number I-1007-10.

B) With the exception of the —10°C. selector switch, control console setup will be identical as described previously. Since there is no cold cycle specified in these tests, the selector switch is left in the +25°C. position at all times.

C) Programmer and cam calibrating techniques are the same as previously described. With cam followers resting on low temperature position of cams, water level and air flow adjustments should be such that no depression can be seen on the chart. To maintain a 95% relative humidity throughout cycle, wet and dry bulb lines must be on top of each other.

D) When cabinet is supplied with cams cut for these programs, they are pre-cut with a slight depression at high side of program. You will note that at the beginning of the 16 hour down slope, the dry bulb cam is curved to move dry bulb cam follower in a position to close the dry bulb heat off completely throughout the 16 hour cycle. Exact calibration for high temperature stabilized portion of the cycle is exactly the same as described for MIL-202C.

E) An alternate method of operating cabinet for positive assurance of 95% relative humidity throughout the cycle is turning dry bulb control switch "off" and operating wet bulb control only throughout entire cycle. This automatically produces a condition at or slightly below 100% relative humidity throughout entire cycle. When using this method, condensation will form on initial run up, and because the humidity is so high, condensation remains in the cabinet throughout the entire 10-day cycle.

F) You will note that emphasis has been placed on the elimination of any visible depression during the 16 hour down slope. Looking at a circular chart recording of any MIL specification, it is virtually impossible to exactly determine the relative humidity during the transition of one stabilized condition to another. Only during stabilized portions of the program can an accurate relative humidity determination be made with a circular chart recording. Blue M has determined, through monitoring the entire cycle with a quality differential recorder, that the wet and dry bulb lines must curve down and appear as one single line to legitimately meet the 95% requirement. A differential recorder is a measuring device with two sensing elements, either thermocouples or resistance bulbs, that are connected in a bridge circuit of opposite polarity. The recording pen records THE DIFFERENCE IN TEMPERATURE BETWEEN THE TWO SENSING ELEMENTS. Thus, the name "differential". In our case, two resistance bulbs are installed in the conventional wet and dry bulb manner, with a wick on the wet bulb sensing device. They are connected to a 12" strip chart recorder covering 10°F. full scale, with 1/10°F. divisions. With this instrument, we are able to obtain a continuous recording of wet bulb depression throughout the entire cycle.

NON-CYCLING MECHANICAL REFRIGERATION SYSTEM FOR SINGLE STEADY-STATE OR FULL RANGE MODELS

I. DESCRIPTION OF OPERATION

(Refer to Refrigeration Schematic Diagram)

A. High Temperature Circuit - The high temperature cooling circuit is energized by placing the "High-Low" selector switch in the "High" position. This activates the high temperature solenoid valve, which allows refrigerant to flow through the bare tube evaporator coil, located in the water resevoir.

Generally speaking, the "high temperature circuit" should be energized for all high humidity conditions at ambient temperatures and above. The high temperature circuit must not be used below +25°C. It is used to provide a minimum constant cooling rate to insure steady wet bulb depression throughout all high temperature cycles.

NOTE: When starting humidity chamber after a shutdown period of 24 hours or longer, place the "High-Low" selector switch in the "Low" position and allow chamber to operate 5-10 minutes. The selector switch may then be switched to the position required by chamber condition. This prevents "Oil Foaming" in the compressor and extends its life.

B. Low Temperature Circuit - The low temperature cooling circuit is activated by placing the "High-Low" selector switch in the "Low" position. This energizes the low temperature solenoid valve and allows refrigerant to flow through the finned evaporator coil.

Use the low temperature circuit only for sub-ambient temperatures and to simulate extremely low humidities at low dry bulb temperatures. During low temperature circuit operation the refrigeration system is operating at maximum capacity. If used in High Humidity conditions above +90°F., compressor will overheat.

II. PRESSURE GAUGES

All chambers are equipped with 2 gauges marked "High" and "Low". The high pressure gauge is connected in the compressor discharge line and the low pressure gauge is connected to the suction line. Refer to the chart for proper gauge pressure.

When contacting Blue M for service information, note pressure gauge readings, "High-Low" selector switch setting, and the chamber temperature. We need this information to serve you properly.

III. REFRIGERATION CHARGE

Only qualified refrigeration servicemen should be allowed to charge refrigeration system. The proper weight and type of refrigerant will be found on the specification plate. (Also see chart below) Given weights include and adequate reserve. The system can be High side liquid charged or Low side vapor charged. Initial charging should be through the high side, since it is a more rapid method. An indicator is installed in the liquid line to indicate when system is fully charged.

NOTE: It is important to remember that the "High-Low" selector switch must be in the "Low" position when charging or observing the liquid indicator.

IV. MAINTENANCE

A preventive maintenance program should be scheduled so that refrigeration system is regularly checked for leaks and low compressor oil level. Approximately 1000 hours of operation should be the inspection interval. The inspection also should be in accordance with generally accepted commercial practice. Two inspections per year are minimum.

A. Air Cooled Condensers - When subject to normal environmental conditions, the air cooled condenser must be cleaned every 6 months. If installed in an abnormally dirty environment, clean more frequently. A high pressure air hose is ideal for this purpose.

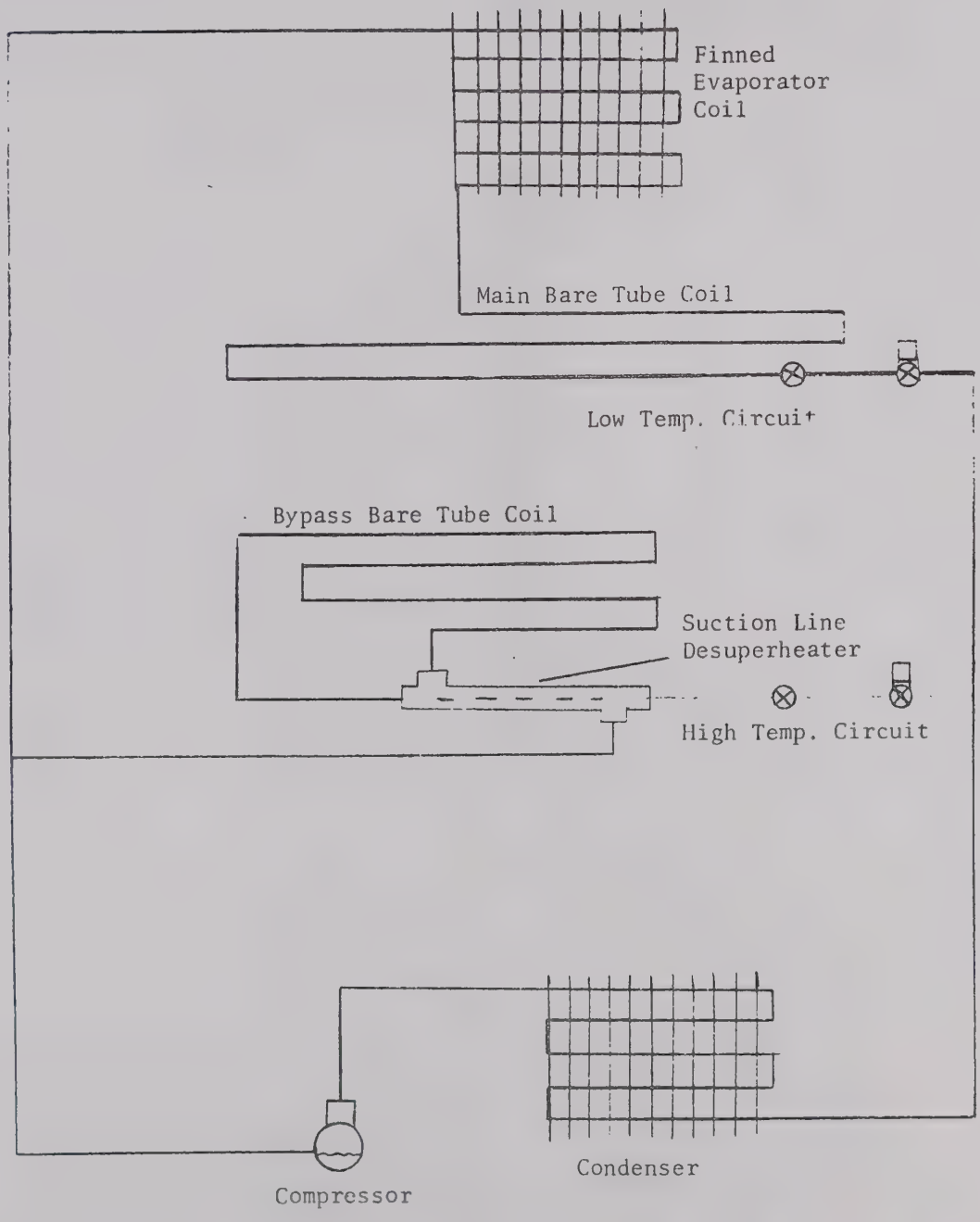
B. Water and Air Cooled Compressors - Allow cabinet to operate 10-15 minutes with "High-Low" selector switch in the "Low" position. The oil level may then be checked with the cabinet still operating.

The recommended oil for our compressors is Suniso #3GS DO NOT OVERFILL. Excessive oil reduces heat transfer and increases temperature differential between the evaporator and condenser.

On consenser fan motors with provisions for oiling, use approximately 20 drops of SAE 10 lubricating oil every 6 months.

C. Refer to chart for pressure gauge readings.

REFRIGERATION SCHEMATIC DIAGRAM



BLUE M
A UNIT OF GENERAL SIGNAL
BLUE ISLAND, ILLINOIS 60406

REFRIGERATION SYSTEM SPECIFICATIONS

MODEL LETTER PREFIX	LOW PRESSURE GAUGE SELECTOR SWITCH		HIGH PRESSURE GAUGE SELECTOR SWITCH		REFRIG. TYPE	HIGH PRESSURE CUT-OUT SETTINGS	
	HIGH	LOW	HIGH	LOW		CUT-IN	CUT-OUT
CFR, CPR FR, POM	3-6	*0-20	**100 TO 140	**100 TO 140	R-12	100	170
LR	2-4	*0-25	**150 TO 200	**160 TO 220	R-502	185	290

ALL PRESSURE READINGS IN POUNDS PER SQUARE INCH GAUGE (PSIG)

* These pressures are determined by the temperature of the test space. At +25°C. or above, the gauge will read the higher pressures; at -10°C. (-40°C for LR series units), the gauge will read approximately 0 PSIG.

** These pressures are determined by the temperature of the ambient air. At +21°C, the gauge will read the lower pressures; at +32°C., the gauge will read the higher pressures.

MODEL	REFRIGERANT CHARGE (LBS)	REFRIGERATION HORSEPOWER
LR-386	10.0	1 1/2
CPR-7502 CPR-7602 CPR-7702 CFR-7552 CFR-7652 CFR-7752 POM-7570 FR	3.0	1/3

BLUE M
A UNIT OF GENERAL SIGNAL
BLUE ISLAND, ILLINOIS 60406

FAHRENHEIT TABLE OF RELATIVE HUMIDITY OR PERCENT OF SATURATION

BLUE M

BLUE M Engineering Company

A DIVISION OF BLUE M ELECTRIC COMPANY
CORPORATE HEADQUARTERS: BLUE ISLAND, ILLINOIS 60406
Area Code 312; Phones 385-9000 • 468-7755 • TWX: 910-689-3398

Arizona, Scottsdale 85251
California, El Monte 91731
California, Los Altos 94022
Connecticut, Milford 06460
Georgia, Atlanta 30305
Massachusetts, Framingham 01701
Michigan, Oak Park 48237
New York; New Rochelle 10801
Ohio, Cincinnati 45237
Pennsylvania, Ardmore 19003
Texas, Garland 75040
Washington, Seattle 98109

Dry Bulb Deg. F.	Difference Between Readings of Wet and Dry Bulbs in Degrees Fahrenheit																															Dry Bulb Deg. F.
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	22	24	26	28	30	32	34	36	38	40	45	50	55	60	70	
30	89	78	67	56	46	36	26	16	6	0	0																									30
35	91	81	72	63	54	45	36	27	19	10	2	0																								35
40	92	83	75	68	60	52	45	37	29	22	15	7	0	0																						40
45	93	86	78	71	64	57	51	44	38	31	25	18	12	6	0	0																				45
50	93	87	80	74	67	61	55	49	43	38	32	27	21	16	10	5	0	0																		50
55	94	88	82	76	70	65	59	54	49	43	38	33	28	23	19	14	9	5	0	0																55
60	94	89	83	78	73	68	63	58	53	48	43	39	34	35	26	21	17	13	9	5	0															60
65	95	90	85	80	75	70	66	61	56	52	48	44	39	35	31	27	24	20	16	12	5	0														65
70	95	90	86	81	77	72	68	64	59	55	51	48	44	40	36	33	29	25	22	19	12	6	0	0												70
75	96	91	86	82	78	74	70	66	62	58	54	51	47	44	40	37	34	30	27	24	18	12	7	1	0											75
80	96	91	87	83	79	75	72	68	64	61	57	54	50	47	44	41	38	35	32	29	23	18	12	7	3	0										80
85	96	92	88	84	80	76	73	70	66	63	59	56	53	50	47	44	41	38	35	32	27	22	17	13	8	4	0	0								85
90	96	92	89	85	81	78	74	71	68	65	61	58	55	52	49	47	44	41	39	36	31	26	22	17	13	9	5	1	0							90
95	96	93	89	85	82	79	75	72	69	66	63	60	57	54	52	49	46	43	42	38	34	30	25	21	17	13	9	6	2	0						95
100	96	93	89	86	83	80	77	73	70	68	65	62	59	56	54	51	49	46	44	41	37	33	28	24	21	17	13	10	7	4						100
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104	96	93	90	86	83	80	77	74	71	69	65	63	60	58	55	52	50	48	46	43	39	35	31	27	23											104
106	96	93	90	87	83	80	77	74	72	69	66	63	60	58	56	53	51	48	46	44	40	36	32	28	24	21										106
108	96	93	90	87	84	81	78	75	72	70	66	64	61	59	56	54	51	49	47	45	41	37	33	29	26	22	19									108
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116	97	93	90	88	84	82	79	76	74	71	68	66	63	61	59	56	54	52	50	48	44	40	36	33	29	26	24	20	17	14						116
118	97	93	91	88	85	82	79	76	74	71	68	66	64	62	59	57	54	53	51	49	44	41	37	34	30	27	24	21	19	15						118
120	97	94	91	88	85	82	79	77	74	72	69	66	64	62	60	57	55	53	51	49	45	41	38	34	31	28	25	22	19	16	10					120
122	97	94	91	88	85	82	79	77	75	72	69	67	65	63	60	58	56	54	52	50	46	42	38	35	32	29	26	23	20	17	12					122
124	97	94	91	88	85	83	80	77	75	72	70	67	65	63	61	58	56	54	52	51	46	43	39	36	33	29	27	24	21	18	13					124
126	97	94	91	88	86	83	80	78	75	73	70	68	65	64	61	59	57	55	53	51	47	43	40	37	33	30	28	25	22	19	14					126
128	97	94	91	89	86	83	80	78	76	73	71	68	66	64	61	59	57	55	53	52	47	44	40	37	34	31	28	25	23	20	15					128
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132	97	94	92	89	86	83	81	78	76	74	71	69	67	65	62	60	58	56	54	53	49	45	42	39	35	32	30	27	24	22	16	11				132
134	97	94	92	89	86	84	81	79	76	74	71	69	67	65	63	61	59	57	55	53	49	46	42	39	36	33	31	28	25	23	17	12				134
136	97	94	92	89	86	84	81	79	77	74	72	69	67	65	63	61	59	57	55	53	50	46	43	40	37	34	31	28	26	24	18	13				136
138	97	94	92	89	86	84	81	79	77	74	72	70	68	66	63	62	60	58	56	54	50	47	43	40	37	35	32	29	27	24	19	14				138
140	97	94	92	89	87	84	81	79	77	75	72	70	68	66	64	62	60	58	56	54	51	47	44	41	38	35	33	30	27	25	19	14	10			140
142	97	94	92	89	87	84	82	80	77	75	73	70	68	66	64	62	60	58	57	55	51	48	44	42	39	36	33	30	28	26	20	15	11			142
144	97	95	92	89	87	84	82	80	78	75	73	71	69	67	65	63	61	59	57	55	52	48	45	42	39	36	34	31	29	26	21	16	11			144
146	97	95	92	90	87	85	82	80	78	75	73	71	69	67	65	63	61	59	57	56	52	49	45	43	40	37	35	32	29	27	21	17	12			146
148	97	95	92	90	87	85	82	80	78	76	73	71	69	67	65	63	61	60	58	56	53	49	46	43	40	38	35	32	30	28	22	17	13			148
150	98	95	92	90	87	85	82	80	78	76	74	72	70	68	66	64	62	60	58	57	53	49	46	43	41	38	36	33	30	28	23	18	13			150
152	98	95	93	90	88	85	83	81	79	76	74	72	70	68	66	64	62	60	59	57	53	50	47	44	41	39	36	33	31	29	23	19	14	10		152
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156	98	95	93	90	88	85	83	81	79	77	74	72	71	69	67	65	63	61	59	58	54	51	48	45	42	40	37	34	32	30	24	20	15	11		156
158	98	95	93	90	88	86	83	81	79	77	75	73	71	69	67	65	63	61	60	58	55	51	48	45	43	40	38	35	33	30	25	20	16	12		158
160	98	95	93	90	88	86	83	81	79	77	75	73	71	69	67	65	64	62	60	58	55	52	49	46	43	41	38	35	33	31	25	21	17	13		160
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164	98	95	93	91	88	86	84	82	80	78	75	73	72	70	68	66	64	62	61	59	56	52	49	47	44	41	39	36	34	32	26	22	18	14		164
166	98	95	93	91	88	86	84	82	80	78	76	74	72	70	68	66	65	63	61	59	56	53	50	47	44	42	39	37	35	32	27	23	18	14		166
168	98	95	93	91	88	86	84	82	80	78	76	74	72	70	68	67	65	63	61	60	56	53	50	47	45	42	40	37	35	33	28	23	19	15		168
170	98	95	93	91	89	86	84	82	80	78	76	74	72	70	69	67	65	63	62	60	57	53	51	48	45	43	40	38	35	33	28	24	19	15		170
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174	98	95	93	91	89	87	84	83	81	78	76	75	73	71	69	67	66	64	62	61	57	54	51	49	46	43	41	39	36	34	29	24	20	16		174
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186	98	96	94	92	90	87	85	83	82	80	78	76	74	72	71	69	67	66	64	62	59	56	53	51	48	46	43	41	39	37	32	27	23	19	13	186
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190	98	96	94	92	90	88	85	84	82	80	78	76	75	73	71	69	68	66	65	63	60	57	54	51	49	46	44	42	39	37	32	28	24	20	14	190
200	98	96	94	92	90	88	86	84	82	80	79	77	75	74	72	70	69	67	66	64	61	58	55	53	51	48	46	43	41	39	34	30	26	22	16	200
205	98	96	94	92	90	88	86	84	83	81	79	77	76	74	72	71	69	68	66	65	62	59	56	54	51	49	46	44	42	40	35	31	27	23	17	205
210	98	96	94	93	90	88	87	85	83	81	80	78	76	75	73	71	70	68	67	65	62	60	57	54	52	49	47	45	43	41	36	32	28	24	18	210

CENTIGRADE TABLE OF RELATIVE HUMIDITY OR PERCENT OF SATURATION

Dry Bulb Deg. C.	Difference Between Readings of Wet and Dry Bulbs in Degrees Centigrade																														Dry Bulb Deg. C.
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5	6	7	8	9	10	11	12	13	14	15	16	18	20	22	24	26	28	30	32	34	36	38	40	
2	92	83	75	67	59	52	43	36	27	20																							2
4	93	85	77	70	63	56	48	41	34	28	15																						4
6	94	87	80	73	66	60	54	47	41	35	23	11																					6
8	94	87	81	74	68	62	56	50	45	39	28	17																					8
10	94	88	82	76	71	65	60	54	49	44	34	23	14																				10
12	94	89	84	78	73	68	63	58	53	48	38	30	21	12	4																		12
14	95	90	84	79	74	69	65	60	55	51	41	33	24	16	10																		14
16	95	90	85	91	76	71	67	62	58	54	45	37	29	21	14	7																	16
18	95	90	86	82	78	73	69	65	61	57	49	42	35	27	20	13	6																18
20	96	91	87	82	78	74	70	66	62	58	51	44	36	30	23	17	11																20
22	96	92	87	83	79	75	72	68	64	60	53	46	40	34	27	21	16	11															22
24	96	92	88	85	81	77	74	70	66	63	56	49	43	37	31	26	21	14	10														24
26	96	92	89	85	81	77	74	71	67	64	57	51	45	39	34	28	23	18	13														26
28	96	92	89	85	82	78	75	72	68	65	59	53	47	42	37	31	26	21	17	13													28
30	96	93	89	86	82	79	76	73	70	67	61	55	50	44	39	35	30	24	20	16	12												30
32	96	93	90	86	83	80	77	74	71	68	62	56	51	46	41	36	32	27	23	19	15												32
34	97	93	90	87	84	81	77	74	71	69	63	58	53	48	43	38	34	30	26	22	18	10											34
36	97	93	90	87	84	81	78	75	72	70	64	59	54	50	45	41	36	32	28	24	21	13											36
38	97	94	90	87	84	81	79	76	73	70	65	60	56	51	46	42	38	34	30	26	23	16	10										38
40	97	94	91	88	85	82	79	76	74	71	66	61	57	52	48	44	40	36	32	29	25	19	13										40
42	97	94	91	88	85	82	80	77	74	72	67	62	58	53	49	45	41	38	34	31	27	21	15										42
44	97	94	91	88	86	83	80	77	75	73	68	63	59	54	50	47	43	39	36	32	29	23	17	12									44
46	97	94	91	89	86	83	81	78	76	73	68	64	60	55	52	48	44	41	37	34	31	25	19	14									46
48	97	94	92	89	86	84	81	78	76	74	69	65	61	56	53	49	45	42	39	35	33	27	21	16	12								48
50	97	94	92	89	87	84	82	79	77	75	70	65	62	57	54	50	47	43	40	37	34	28	23	18	14								50
52	97	94	92	89	87	84	82	79	77	75	70	66	62	58	55	51	48	44	41	38	35	30	25	20	16	11							52
54	97	95	92	90	87	85	82	80	78	76	71	67	63	59	56	52	49	45	42	39	36	31	26	21	17	13							54
56	97	95	92	90	87	85	83	80	78	76	72	68	64	60	57	53	50	46	43	40	38	32	27	23	19	15	11						56
58	97	95	93	90	88	85	83	80	79	77	72	68	64	61	57	54	51	47	44	42	39	33	29	24	20	16	12						58
60	98	95	93	90	88	86	83	81	79	77	73	69	65	62	58	55	52	48	45	43	40	35	30	26	21	16	14	11					60
62	98	95	93	91	88	86	84	81	79	78	73	69	66	62	59	56	53	49	46	43	41	36	31	27	23	19	15	12					62
64	98	95	93	91	88	86	84	82	80	78	74	70	66	63	59	56	53	50	47	44	42	37	32	28	24	20	17	13					64
66	98	95	93	91	89	86	84	82	80	78	74	70	67	64	60	57	54	51	48	45	43	38	33	29	25	21	18	15	12				66
68	98	95	93	91	89	87	85	82	81	79	75	71	67	64	61	58	55	52	49	46	44	39	34	30	26	22	19	16	13				68
70	98	96	93	91	89	87	85	83	81	79	75	71	68	65	61	58	55	52	50	47	44	40	35	31	27	23	20	17	14	11			70
72	98	96	94	92	89	87	85	83	81	80	76	72	69	65	62	59	56	53	50	48	45	40	36	32	28	24	21	18	15	12			72
74	98	96	94	92	90	87	85	83	82	80	76	72	69	66	63	60	57	54	51	49	46	41	37	33	29	25	22	19	16	13	11		74
76	98	96	94	92	90	88	86	84	82	80	76	73	70	66	63	60	57	54	52	49	47	42	38	34	30	26	23	20	17	14	12		76
78	98	96	94	92	90	88	86	84	82	81	77	73	70	67	64	61	58	55	52	50	47	43	38	34	30	27	24	21	18	15	13	10	78
80	98	96	94	92	90	88	86	84	83	81	77	74	71	67	64	61	58	56	53	50	48	43	39	35	31	28	24	22	19	16	14	11	80
82	98	96	94	92	90	88	86	84	83	81	77	74	71	68	65	62	59	56	54	51	49	44	40	36	32	29	25	22	20	17	15	12	10	82
84	98	96	94	92	90	88	86	85	83	81	78	74	71	68	65	62	59	57	54	52	49	45	40	37	33	29	26	23	20	18	16	13	11	84
86	98	96	94	92	91	89	87	85	83	82	78	75	72	69	66	63	60	57	55	52	50	45	41	37	34	30	27	24	21	19	16	14	12	86
88	98	96	95	93	91	89	87	85	83	82	78	75	72	69	66	63	60	58	55	53	51	46	42	38	34	31	28	25	22	19	17	15	13	88
90	98	97	95	93	91	89	87	85	84	82	79	76	73	69	67	64	61	58	56	53	51	47	42	39	35	32	28	26	23	20	18	16	14	90
92	98	97	95	93	91	89	87	86	84	82	79	76	73	70	67	64	61	59	56	54	52	47	43	39	36	32	29	26	24	21	19	16	14	92
94	99	97	95	93	91	89	88	86	84	83	79	76	73	70	67	65	62	59	57	54	52	48	44	40	36	33	30	27	24	22	19	17	15	94
96	99	97	95	93	91	90	88	86	84	83	80	76	74	70	68	65	62	60	57	55	53	48	44	41	37	34	31	28	25	22	20	18	16	96
98	99	97	95	93	92	90	88	86	85	83	80	77	74	71	68	65	63	60	58	55	53	49	45	41	38	34	31	28	26	23	21	19	16	98
100	99	97	95	93	92	90	88	86	85	83	80	77	74	71	69	66	63	60	58	56	54	49	45	42	38	35	32	29	26	24	22	19	17	100

SOLID-STATE WATER LEVEL CONTROL SYSTEM AS USED ON BLUE M TEMPERATURE/HUMIDITY CHAMBERS

Precision water level control is of extreme importance whenever accurate control of relative humidity and temperature is desired. Failure to maintain a precise water level will result in instability of the cabinet's temperature and humidity conditions.

Blue M Electric Company has developed a solid-state water level system that combines precise water level control with reliability. A general description of its operation follows. Refer to Fig. 1.

FIGURE 1

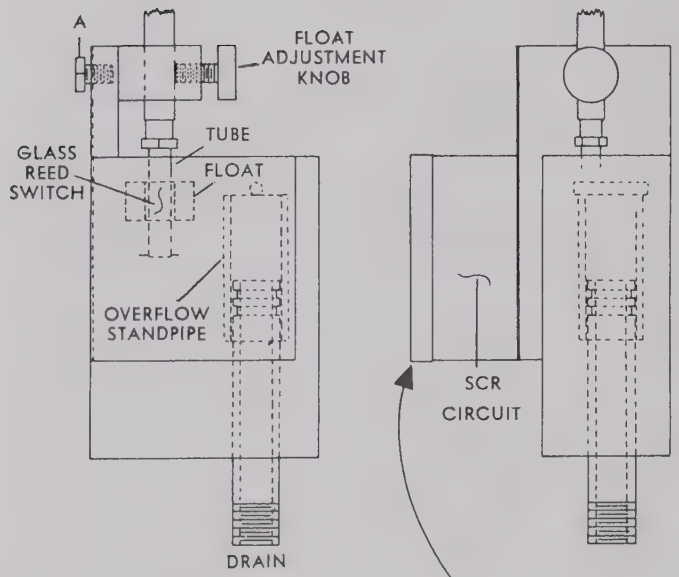
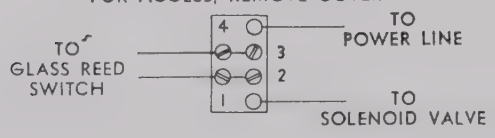


FIGURE 2

TERMINAL STRIP CONNECTIONS
FOR ACCESS, REMOVE COVER



A stainless steel water box is externally mounted so that its water level always indicates the water level in the chamber. An adjustable safety overflow is provided to allow water to run off in event of water control failure or a "sticking" solenoid valve. A highly sensitive glass reed switch is "epoxied" into an adjustable stainless steel tube which is vertically mounted in the water box. A permanent magnet is molded into a doughnut-shaped float which, in turn, is allowed to float up or down around the tube. Whenever the float is below the reed switch, the reed switch closes and water flows into the water reservoir. Whenever the float is at the same level or above the reed switch, the reed switch is open. This reed switch is electrically connected to the gate circuit of the silicon controlled rectifier circuit. Refer to Fig. 2. This controls the power to the "water in" solenoid valve.

The SCR circuit has many advantages over a mechanical relay. The primary one is that it tremendously extends the life of the glass reed switch. The current needed to energize the SCR circuit is approximately one-thousandth of the value needed to energize a relay coil. This assures millions of operations of the reed switch without fear of failure due to deteriorated contacts as produced by heavy arcing.

Adjusting the Water Level

The water level is factory set and should cover 90% of all applications.

NOTE: If the humidity cabinet was originally ordered for a specific test condition, the water level is set accordingly.

If ever required, adjustment can be accomplished by merely loosening the knurled knob that holds the level switch in position. If the cabinet is to be used continuously at low humidities, the water level may have to be lowered.

Adjusting the Overflow Standpipe

The overflow standpipe is also factory set. It should be approximately 1/4 inch above the actual water level. It functions primarily as a safety device only. If the water level control or the "water in" solenoid fail, the overflow standpipe allows the water to flow into a suitable drain, instead of flooding the cabinet or spilling onto the floor.

Maintenance

The water box should be cleaned approximately every four months. At this time it is also advisable to clean and check the float and the tube containing the reed switch. The float should also be checked to be sure that it is not becoming waterlogged. This may be accomplished by removing the hex-head bolt (A) and then removing the float from the tube.

The above cleaning procedure will prevent any possible sticking due to gummy residues forming on the float or the tube.

CAUTION: When replacing the float and tube assembly, be sure to install the float with the blue dot UP. Inverting the float reverses the action of the glass reed switch.

NOTE: If the cabinet appears to be using an exceptionally large amount of water, the blower shaft seal should be checked. It is probably worn and should be replaced.

Trouble-Shooting Procedure

A failure of the water level control to function properly will be evidenced by two abnormal conditions.

1. Water flows continuously through the overflow drain even though the float is pushed completely to the top of the switch tube.

2. No water flows even though the water level has obviously lowered and the float is all the way down at the bottom of the tube. If either of these conditions is noted, carry out the below listed trouble shooting techniques.

   a) With the chamber energized, manually push the float up and down and note the action of the pilot light on the front panel. If this is switching on and off properly, it may be safely assumed that neither the float switch nor the SCR switch has failed. The trouble will undoubtedly be in the solenoid valve, a restriction in the water line or a completely clogged water strainer.

   b) If the pilot light does not indicate a regular On-Off action, then the trouble should be isolated to either the float switch or the SCR switch. With the power to the chamber disconnected, disconnect the two leads from the float switch that are connected to the gate circuit of the SCR switch. Connect an ohmmeter to the two leads and manually move the float up and down. You should have continuity when the float is below the center and the circuit should be open when the float is above center. If this switching action is not occuring, then it may be safely assumed that the level switch itself is defective. Replace it with a new one.

   c) If the switch action is occuring, then it may be safely assumed that the SCR circuit is defective. Replace it with a new one.

All parts are carried in stock at the factory for immediate delivery. Consult wiring diagram and parts list for exact part numbers and prices.

BLUE M
A UNIT OF GENERAL SIGNAL
BLUE ISLAND, ILLINOIS 60406

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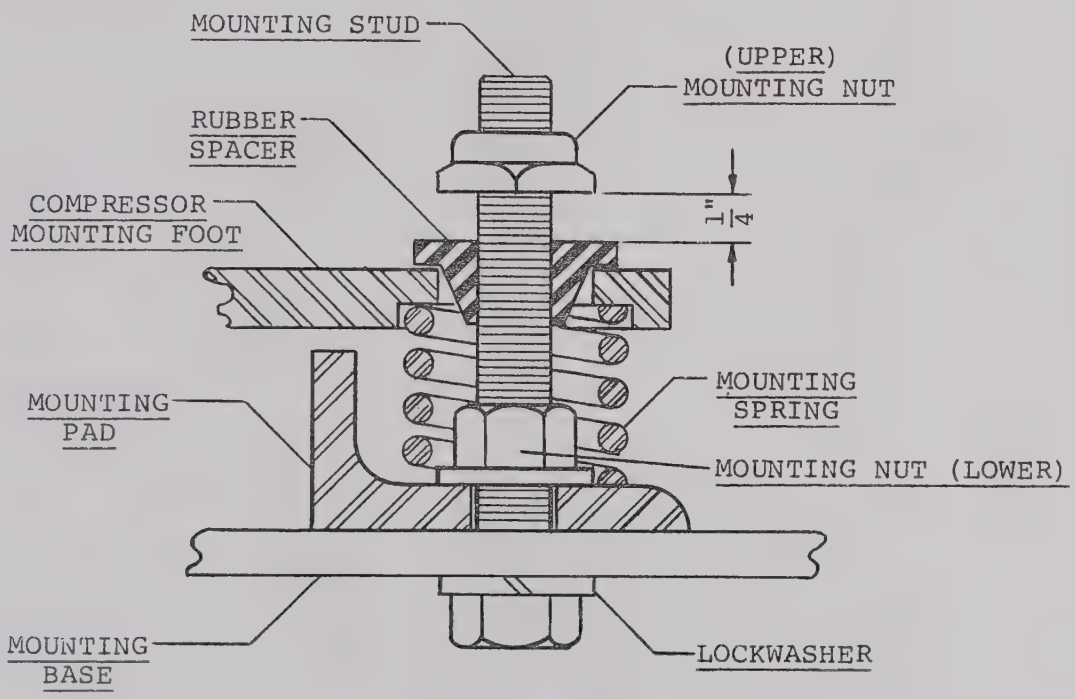
ABP-1M-178

TYPICAL COPELAND COMPRESSOR MOUNT

NOTE: RUBBER SPACERS ARE REMOVED FOR SHIPMENT AND ATTACHED TO COMPRESSOR. AT INSTALLATION, REPLACE RUBBER SPACERS AND POSITION MOUNTING NUT ON STUD AS ILLUSTRATED.



SECTION VIEW

BLUE M

BLUE M *Electric Company*

Corporate Headquarters: BLUE ISLAND, ILLINOIS 60406

MODEL NUMBER: FR-256P
VOLTAGE: ALL
MAX. TEMPERATURE: -18°C to 93°C
MAX. WATTS: 7KW Heating, .75KVA Cooling
INTERIOR DIMENSIONS: 25W x 20D x 21H

MPL-32A

Page of

*PARTS NOT SHOWN
**OPTIONAL ACCESSORIES

Parts shipped F. O. B. Blue Island, Illinois. — When ordering parts, give Model No., Serial No., Voltage and Part No.

ITEM	DESCRIPTION	PART NUMBERS	REQ'D.
* 1	SENSING BULB & BELLOWS ASSEMBLY (SUPP. WITH TEMP CON	C11A-10	2
* 2	BLOWER WHEEL	M10-B104	1
* 3	BLOWER SHAFT	M06-D5-1	1
* 4	BLOWER SHAFT GASKET	M05-B116	1
* 5	BLOWER BEARINGS - PILLOW BLOCKS	M07-A14	2
* 6	BLOWER PULLEY	M08-A57	1
* 7	MOTOR PULLEY	M08-A25	1
* 8	VEE BELT	M09-C8	1
9			
10			
*11	INNER GLASS DOOR - GLASS	M14-C24	1
*12	INNER GLASS DOOR - GASKET	M05-A1-98"	1
*13	INNER GLASS DOOR - LATCH	M02-K1	3
*14	OUTER DOOR LATCH AND STRIKE - COMPLETE	M02-G1	1
*15	OUTER DOOR HINGES	M01-B1	2
*16	OUTER DOOR GASKET	M05-A1-120"	1
*17	FEED THRU TERMINAL	E19D-5	2
*18	RUBBER PLUGS	M05-G8	1
*19	WATER LEVEL CONTROL FLOAT	LF-100	1
*20	WATER LEVEL CONTROL "O" RING SEAL	M05-C2	2
*21	WATER BOTTLE	M14-A1	1
*22	SHELF & MOUNTING BRACKETS	M04-A110	1
*23	BLANK PROGRAMMER CAMS - 24 HR	C10B-3-2	As Req'd
*24	BLANK PROGRAMMER CAMS - 7 DAY	C10B-3-3	As Req'd
25			
*26	0 to 200°F RECORDER CHARTS 24 HOUR ROTATION	C10A-1-51	BOX of100
*27	-18 to 94°C RECORDER CHARTS 24 HOUR ROTATION	C10A-1-52	"
*28	0 to 200°F RECORDER CHARTS 7 DAY ROTATION	C10A-1-53	"
*29	-18 to 94°C RECORDER CHARTS 7 DAY ROTATION	C10A-1-54	"
30			
31			
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49	DATE: 3/28/80 BY: L.S. CHK: DP APP: WS		
50			

MODEL NUMBER: FR-251;256P VOLTAGE: 240V/1Ph/60Hz RB-31M-01-1B

A	ITEM 13 WAS R45/E-06	6-30-77		
B	ITEM 9 WAS R42-10, ITEM 10 WAS R16-15	10-23-78		

ITEM NO.	DESCRIPTION	PART NUMBER	NO. REQD.	PRICE EACH
1	3/4 H.P. Condensing Unit, Air Cooled	R11B-05	1	
2	Motor Compressor (Supplied w/Item 1)	R28B-02		
3	Condenser (Supplied with Item 1)			
4	Condenser Fan Motor (Supplied with Item 1)			
5	Liquid Receiver (Supplied with Item 1)			
6	Receiver Shut-Off Valve (Supplied with Item 1)			
7	Pressure Relief Valve (Supplied with Item 1)			
8	Discharge Vibration Absorber (Supplied with Item 1)			
9	Liquid Indicator	R42-02	1	
10	Filter Drier	R16-17	1	
11	Main Solenoid Valve	E14E-1-1	1	
12	By-Pass Solenoid Valve	E14E-1-1	1	
13	Main Thermo-Expansion Valve	R51E-02	1	
14	Automatic Expansion Valve	R49-A04	1	
15	Finned Cooling Coil	M19-F9	1	
16	Main Dehumidifying Coil	M19-D14	1	
17	By pass Dehumidifying Coil (Supplied with Item 16)			
18	Suction Line Vibration Absorber	R61-04	1	
19	Low Pressure Gauge	R38-01	1	
20	High Pressure Gauge	R38-02	1	
21	High Pressure Cut-Out	R37B-01	1	
22	Low Pressure Cut-Out	Not Supplied		
23	Suction Line DeSuperheater	M19-E7	1	
24	Suction Line Accumulator	R01-02	1	
25	Check Valve	R06-04	1	
26				
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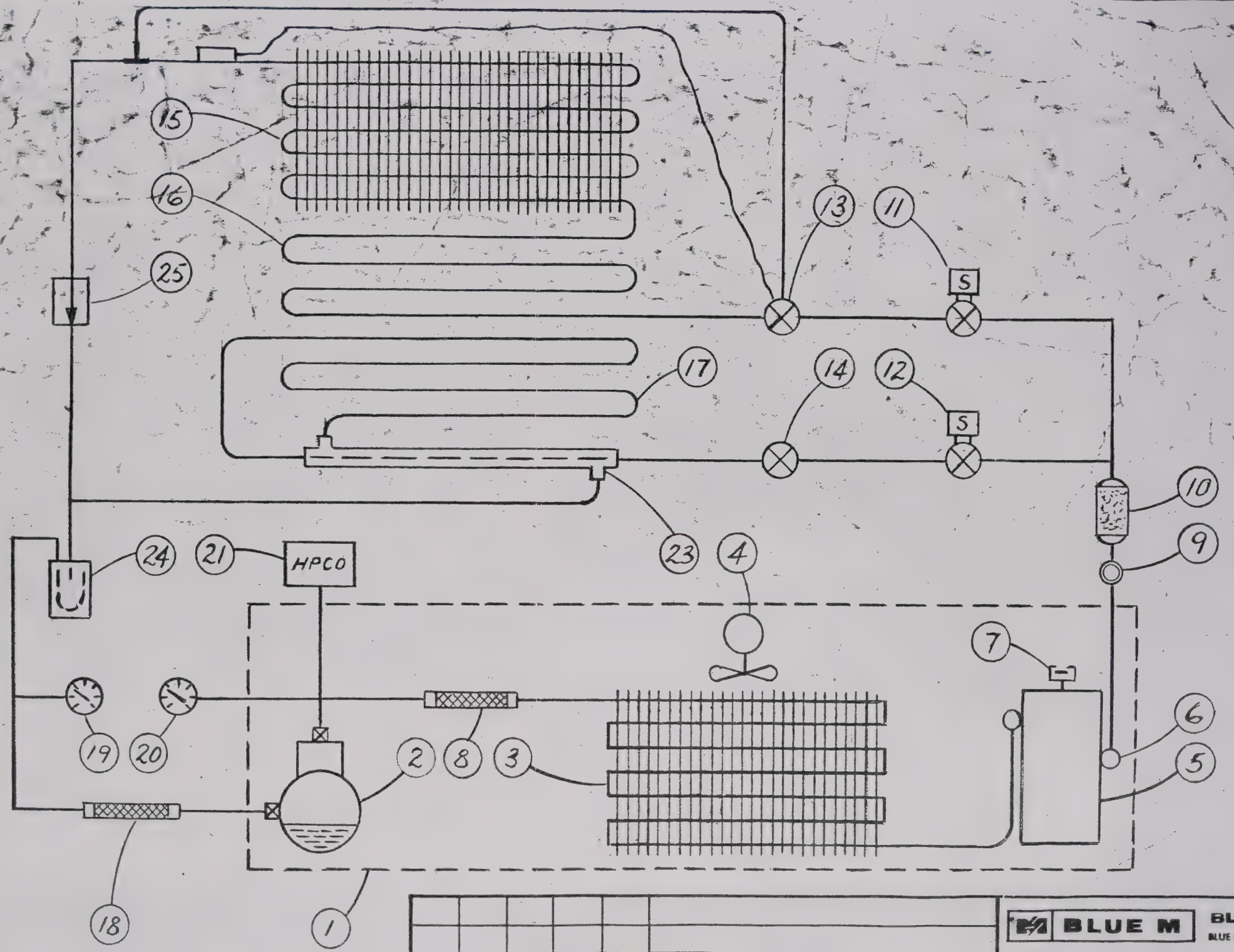
* PARTS NOT SHOWN.

Prices subject to change without notice. Parts shipped F.O.B. Blue Island, Illinois.
When ordering parts, give MODEL NO., SERIAL NUMBER, VOLTAGE and PART NO.



LET.	BY	DATE	CHKD.	APPR.	REVISIONS

BLUE M

BLUE M Electric Company
BLUE ISLAND, ILLINOIS 60406

PART NAME REFRIGERATION SCHEMATIC

USED ON SINGLE STAGE SYSTEMS

SCALE	DATE	DRAWING NO.	REV.
NONE	4-17-75	RS-01	

DRAWN	CHKD	APPR.
KAY	KTS	NC

ITEM	DESCRIPTION	PART NUMBERS	REQ'D.
	ADDITIONS & REVISIONS TO STANDARD PARTS LIST		
1 INST	DIFFERENTIAL RECORDER - 24 HOUR (-18°C to +94°C)	C05B-2-5	1
	DIFFERENTIAL RECORDER - 7 DAY (-18°C to +94°C)	C05B-2-6	1
	DIFFERENTIAL RECORDER - 24 HOUR (-46°C to +150°C)	(See spec sheet for part #)	
	Differential RECORDER - 7 DAY (-46°C to +150°C)	(See spec sheet for part #)	
3 RTD	RECORDER SENSOR - DRY BULB (100 OHM PLATINUM)	C11C-1-5	1
4,5RTD	RECORDER SENSOR - WET BULB DIFFERENTIAL (200 OHM PLATINUM)	C11C-1-6	2
1 ABU	ALARM BUZZER - BACK-UP OVERTEMPERATURE CONTROL	E01-1	1
1 CB	CIRCUIT BREAKER - BACK-UP OVERTEMPERATURE RESET	C03C-4-1	1
3 CON	CONTACTOR - BACK-UP OVERTEMPERATURE CONTROL (USE SAME SIZE AS 1 CON ON PWD)		1
6 INST	TEMPERATURE CONTROL - BACK-UP OTP	C03B-1-6	1
4 LT	PILOT LIGHT - BACK-UP OVERTEMPERATURE CUT - OUT (AMBER)	E06B-1	1
4 RES	RESISTOR - BACK-UP OVERTEMPERATURE CONTROL	E03A-5-4	1
1 T/C	THERMOCOUPLE (TYPE T)	C11B-2-1	1
9 TGS	TOGGLE SWITCH - INTERIOR LIGHT	E16A-7	1
WLT	INTERIOR LIGHT - BULB (100 WATT, 120 VOLT)	E06F-8	1
DISC	FUSE DISCONNECT SWITCH (SEE SPEC. SHEET FOR PART #)		1
7INST	DIGITAL TEMPERATURE INDICATOR (°C)	C01F-6	1
	DIGITAL TEMPERATURE INDICATOR (°F)	C01F-7	1
6 RTD	RTD 100Ω PLATINUM	C11C-1-7	1
2 ABU	ALARM BUZZER - UNDERTEMPERATURE CONTROL	E01-1	1
2 CB	CIRCUIT BREAKER - UNDERTEMPERATURE RESET	C03C-4-1	1
8 INST	TEMPERATURE CONTROL - UTP	C03B-1-13	1
5 LT	PILOT LIGHT - UNDERTEMPERATURE CUT-OUT (AMBER)	E06B-1	1
5 RES	RESISTOR - UNDERTEMPERATURE CONTROL	E03A-5-4	1
3 T/C	THERMOCOUPLE (TYPE T)	C11B-2-1	1
1 CR	CONTOL RELAY	E02C-6	1
1 FS	WATER LEVEL SWITCH AND TUBE ASSY. (PART OF 9 INST)	E16F-1	1
9 INST	WATER LEVEL CONTROL - WICK BOX	E15B-4-1	1
*1 SCR	SOLID STATE SWITCH AND PRINTED CIRUIT ASSY. (PART OF 9 INST)	E15B-1-1	1
6 SOL	SOLENOID VALVE - WICK BOX WATER SUPPLY	E14B-1-2	1
2 CR	CONTROL RELAY - LIVE LOAD INTERLOCK	E02C-6	1
10TGS	TOGGLE SWITCH - PROGRAM/MANUAL CONTROL SELECTOR	E16A-2	1
3 X	REACTOR (VARIABLE)-WET BULB TEMPERATURE CONTROL(-29°C to +104°C)	C03A-5-29	1
	REACTOR (VARIABLE)-WET BULB TEMPERATURE CONTROL (-73°C to +204°C)	C03A-5-1	1
4 X	REACTOR(VARIABLE) - DRY BULB TEMPERATUE CONTROL(-29°C to+104°C)	C03A-5-29	1
	REACTOR (VARIABLE)-DRY BULB TEMPERATURE CONTROL(-73°C to +204°C)	C03A-5-1	1
	SENSING BULB & BELLOWS ASSY. (SUPPLIED WITH TEMP. CONTROLS)-29°C to +104°C	C11A-10	2
	SENSING BULB & BELLOWS ASSY. (SUPPLIED WITH TEMP.CONTROLS)-73°C to +204°C	C11A-4	2

BLUE M

BLUE M Electric Company

Corporate Headquarters: BLUE ISLAND, ILLINOIS 60406

MODEL NUMBER: FR & LR UNITS

VOLTAGE:

MAX. TEMPERATURE:

MAX. WATTS:

INTERIOR DIMENSIONS:

OPWD-963
(OPWD-964)

*PARTS NOT SHOWN

**OPTIONAL ACCESSORIES

Parts shipped F. O. B. Blue Island, Illinois. — When ordering parts, give Model No., Serial No., Voltage and Part No.

ITEM	DESCRIPTION	PART NUMBERS	REQ'D.
	ADDITIONS & REVISIONS TO STANDARD PARTS LIST		
3 CR	CONTROL RELAY	E02C-1	1
4 CR	CONTROL RELAY	E02C-12	1
10 INST	DELAY TIMER	C12C-2	1
1S	INNER DOOR MICROSWITCH	E16H-6	1

REV	REASON	DATE	BY	CHK	APP
~	RE-TYPED WITH LR PARTS ADDED	12-1-80	JT	DP	W S
~	7-INST WAS COIF-1 & COIF-2, ADDED 6RTD	4-27-81	G.B	DP	W S

BLUE M

BLUE M Electric Company

[illegible] Headquarters [illegible] AND, ILLINOIS 60406

MODEL NUMBER [illegible]
VOLTAGE: 208V
MAX. TEMPERATURE [illegible]
MAX. WATTS 7KW He[illegible]
INTERIOR DIMENSIONS [illegible]

Parts shipped F. O. B. [illegible] Island, Illinois — When ordering parts, give Model

ITEM	DESCRIPTION		PART NUMBERS	REQ'D
ABU	ALARM BUZZER	EM	E19B-9	1
1 AT	AUTOTRANSFORMER (8KVA)	VM AND 2VM)	E03A-2-65	2
2,3AT	AUTOTRANSFORMER		E03A-5-4	1
CB	CIRCUIT BREAKER - OVERTEMPERATURE RE[illegible]		C11C-1-5	2
1 CON	CONTACTOR - OVERTEMPERATURE	- PART OF 5 INST	E16H-3	1
2 CON	CONTACTOR - COMPRESSOR			
CR	CONTROL RELAY	IT ASSY. (PART OF 2INST)	E15B-1-1	1
DISC	FUSED DISCONNECT SWITCH		E14E-1-1	1
			Not Req'd	
FS	WATER LEVEL SWITCH AND TUBE ASSY. (P[illegible]		E14E-1-1	1
			E14B-1-3	1
1,2FU	FUSE - MAIN (60 AMP)		E14B-1-2	1
3 FU	FUSE - MAIN (3 PHASE ONLY) ([illegible] AMP)			
4,6FU	FUSE - BLOWER MOTOR (7 AMP)		E13-9	1
5 FU	FUSE - BLOWER MOTOR (3 PHASE ONLY)		E13-7	1
,8FU	FUSE - COMPRESSOR (8 AMP)			
9,11 FU	FUSE - WET BULB HEATER (25 AMP)		E17B-2-3	1
10,13FU	FUSE - WET AND DRY BULB REACTOR CONTACTOR)		Not Req'd	
12,14FU	FUSE - DRY BULB HEATER (20 AMP)		Not Req'd	
15 FU	FUSE - 120 VOLT CONTROL CIRCUIT (5 A[illegible]			
			E16B-1	1
1 HTR	HEATING ELEMENT - WET BULB (10 OHMS		E16B-1	1
2 HTR	HEATING ELEMENT - DRY BULB (13.4 OHM		E16A-7	1
			E16B-1	1
1 INST	RECORDER/OTP - 24 HOUR (7 DAY USE CO[illegible]	SELECTOR	E16A-3	1
2 INST	WATER LEVEL CONTROL		Not Req'd	
3,4INST	CONTROL CIRCUIT POWER SUPPLY - WET A[illegible]	CTOR)	E16A-3	1
5 INST	PROGRAMMER CONTROLLER	INST)	E16A-5	1
1 LT	PILOT LIGHT - OVERTEMPERATURE CUT-OUT		C12G-3	1
2 LT	PILOT LIGHT - MAIN (RED)			
3 LT	PILOT LIGHT - WATER SUPPLY (AMBER)		E09-3	2
M	MOTOR STARTER - BLOWER MOTOR	TURE CONTROL (PART OF 5INST)	C03A-5-28	1
1 MTR	MOTOR - BLOWER (1/3 HP)	TURE CONTROL (PART OF 5INST)	C03A-5-27	1
2 MTR	MOTOR - BLOWER			
3 MTR	MOTOR - COMPRESSOR (3/4 HP)			
4 MTR	MOTOR - CAM - 24 HOUR (7 DAY USE E10C			
1OL	OVERLOAD RELAY - BLOWER			
1 OL	OVERLOAD HEATER			
OL	OVERLOAD RELAY - BLOWER			
OL	OVERLOAD HEATER			
1,2PL	POWER SUPPLY PLUG			
1 PS	PRESSURE SWITCH - HIGH PRESSURE CUT-O			
2 PS	PRESSURE SWITCH - LOW PRESSURE CUT-OU			

DP Approved WS

	AMPERES
	49A
	49A

	DATE	BY
D	3-9-82	JE

Form 1-6

BLUE M

BLUE M Electric Company

[illegible] AND, ILLINOIS 60406

MODEL NUMBER FR-256PB-1
VOLTAGE: 208V/1PH/60HZ
MAX TEMPERATURE -18°C TO 93°C
MAX. WATTS 7KW Heating, .75KVA Cooling
INTERIOR DIMENSIONS 25W x 20D x 21H

PWD - 32A-964-1
(PAGE 1 OF 2)
THIS PARTS LIST TO BE USED WITH WIRING DIAGRAM
WD - 964

Parts shipped F. O. B. Blue Island, Illinois — When ordering parts, give Model No., Serial No., Voltage and Part No.

*PARTS NOT SHOWN
**OPTIONAL ACCESSORIES

ITEM	DESCRIPTION	PART NUMBERS	REQ'D.
ABU	ALARM BUZZER	E01-1	1
1 AT	AUTOTRANSFORMER (8KVA)	E17A-2-6	1
2,3AT	AUTOTRANSFORMER	Not Req'd.	
CB	CIRCUIT BREAKER - OVERTEMPERATURE RESET	C03C-4-1	1
1 CON	CONTACTOR - OVERTEMPERATURE	E02F-2-3	1
2 CON	CONTACTOR - COMPRESSOR	E02F-1-1	1
CR	CONTROL RELAY	E02A-12-1	1
DISC	FUSED DISCONNECT SWITCH	Not Req'd	
FS	WATER LEVEL SWITCH AND TUBE ASSY. (PART OF 2 INST)	E16F-1	1
1,2FU	FUSE - MAIN (60 AMP)	E04A-60	2
3 FU	FUSE - MAIN (3 PHASE ONLY)	Not Req'd	
4,6FU	FUSE - BLOWER MOTOR (.7 AMP)	E04M-.7	2
5 FU	FUSE - BLOWER MOTOR (3 PHASE ONLY)	Not Req'd	
7,8FU	FUSE - COMPRESSOR (8 AMP)	E04A-8	2
9,11 FU	FUSE - WET BULB HEATER (25 AMP)	E04C-25	2
10,13FU	FUSE - WET AND DRY BULB REACTOR CONTROL CIRCUIT (1AMP)	E04J-1	2
12,14FU	FUSE - DRY BULB HEATER (20 AMP)	E04C-20	2
15 FU	FUSE - 120 VOLT CONTROL CIRCUIT (5 AMP)	E04J-5	1
1 HTR	HEATING ELEMENT - WET BULB (10 OHMS)	A121-296-1F	1
2 HTR	HEATING ELEMENT - DRY BULB (13.4 OHMS)	A121-513B	1
1 INST	RECORDER/OTP - 24 HOUR (7 DAY USE C05B-2-2)	C05B-2-1	1
2 INST	WATER LEVEL CONTROL	E15B-4-1	1
3,4INST	CONTROL CIRCUIT POWER SUPPLY - WET AND DRY BULB	E15A-2-2	2
5 INST	PROGRAMMER CONTROLLER	C07A-3-7	1
1 LT	PILOT LIGHT - OVERTEMPERATURE CUT-OUT (AMBER)	E06B-1	1
2 LT	PILOT LIGHT - MAIN (RED)	E06B-2	1
3 LT	PILOT LIGHT - WATER SUPPLY (AMBER)	E06B-1	1
M	MOTOR STARTER - BLOWER MOTOR	E11A-1	1
1 MTR	MOTOR - BLOWER (1/3 HP)	E10A-4-13	1
2 MTR	MOTOR - BLOWER	Not Req'd	
3 MTR	MOTOR - COMPRESSOR (3/4 HP)	R28B-02	1
4 MTR	MOTOR - CAM - 24 HOUR (7 DAY USE E10C-8-1) - PART OF 5 INST E10C-5-1		1
1 OL	OVERLOAD RELAY - BLOWER	Part of Item M	
1 OL	OVERLOAD HEATER	E11D-N20	2
2 OL	OVERLOAD RELAY - BLOWER	Not Req'd	
2 OL	OVERLOAD HEATER	Not Req'd	
1,2PL	POWER SUPPLY PLUG	E19A-5	2
1 PS	PRESSURE SWITCH - HIGH PRESSURE CUT-OUT	R37B-01	1
2 PS	PRESSURE SWITCH - LOW PRESSURE CUT-OUT	Not Req'd	

ITEM	DESCRIPTION	PART NUMBERS	REQ'D
RECP	RECEPTACLE - WATER PURIFICATION SYSTEM	E19B-9	1
1,2RES	RESISTOR (SUPPLIED WITH VOLTMETERS 1VM AND 2VM)	E03A-2-65	2
3 RES	RESISTOR - OTP CIRCUIT	E03A-5-4	1
1,2RTD	RECORDER SENSORS (100 OHM PLATINUM)	C11C-1-5	2
S	SWITCH - (-10°C AND +25°C SELECTOR) - PART OF 5 INST	E16H-3	1
*SCR	SOLID STATE SWITCH AND PRINTED CIRCUIT ASSY. (PART OF 2INST) E15B-1-1		1
1 SOL	SOLENOID VALVE - MAIN COOLING COIL	E14E-1-1	1
2 SOL	SOLENOID VALVE - FINNED COOLING COIL	Not Req'd	
3 SOL	SOLENOID VALVE - BYPASS COOLING COIL	E14E-1-1	1
4 SOL	SOLENOID VALVE - CABINET WATER DRAIN	E14B-1-3	1
5 SOL	SOLENOID VALVE - CABINET WATER SUPPLY	E14B-1-2	1
1 SX	SATURABLE REACTOR - WET BULB	E13-9	1
2 SX	SATURABLE REACTOR - DRY BULB	E13-7	1
1 T	TRANSFORMER - CONTROL (500VA)	E17B-2-3	1
2 T	TRANSFORMER - LINE VOLTAGE CHANGE	Not Req'd	
3,4 T	TRANSFORMER - LINE VOLTAGE CHANGE	Not Req'd	
1 TGS	TOGGLE SWITCH - WET BULB HEAT	E16B-1	1
2 TGS	TOGGLE SWITCH - DRY BULB HEAT	E16B-1	1
3 TGS	TOGGLE SWITCH - MAIN	E16A-7	1
4 TGS	TOGGLE SWITCH - COMPRESSOR	E16B-1	1
5 TGS	TOGGLE SWITCH - LOW AND HIGH COOLING SELECTOR	E16A-3	1
6 TGS	TOGGLE SWITCH - FINNED COOLING COIL	Not Req'd	
7 TGS	TOGGLE SWITCH - (-10°C AND +25°C SELECTOR)	E16A-3	1
8 TGS	TOGGLE SWITCH - CAM MOTOR (PART OF 5 INST)	E16A-5	1
TM	ELAPSED TIME METER	C12G-3	1
1,2VM	VOLTMETER WITH RESISTOR	E09-3	2
1X	REACTOR (VARIABLE) - WET BULB TEMPERATURE CONTROL (PART OF 5INST) C03A-5-28		1
2X	REACTOR (VARIABLE) - DRY BULB TEMPERATURE CONTROL (PART OF 5INST) C03A-5-27		1

DATE: 3/20/80 BY: L.S. CHECKED: DP Approved WS

LINE NO.	VOLTAGE	AMPERES
L1	208V	49A
L2	208V	49A

REVISION	REASON	DATE	BY
—	4,6 FU WERE E04J-10	3-9-82	JZ

MP MASTER
MA23140